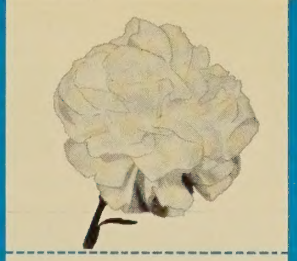
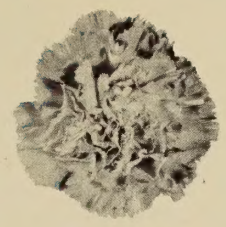
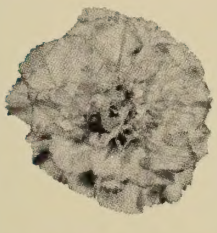




Gloeckner

CARNATION MANUAL

1957 EDITION



Gloeckner carnation MANUAL

The 1957 edition of the

Gloeckner CARNATION MANUAL

contains all the latest information on carnation culture. We offer it each year as a guide to help you grow better and more profitable crops.

CONTENTS OF CARNATION MANUAL

Polyethylene baffles are necessary in greenhouse cooling to keep the cooled air down near the plants. More about the latest developments in greenhouse cooling are found on the pages which follow, and your Gloeckner representative is well qualified to discuss the details of installing greenhouse cooling systems — consult him freely.

TERMS OF SALE

One hundred cuttings of each variety is the minimum that can be supplied, except on those varieties where a 50-rate price is quoted. More than 100 of a variety must be in multiples of 50.

Any changes or cancellations of carnation orders must be received at least six weeks before shipping date. Prices subject to change without notice.

Gloeckner seeds, bulbs, plants and cuttings are selected with diligent care as to type, productiveness and freedom from disease so that you may have the best with which to build your prospective crops. Our interest in you and your crops by no means ends with the sale. We are more than anxious to have the materials we sell, grow and prove profitable to you.

WARRANTY AND LIMITATIONS OF LIABILITY — Subject to the limitations of liability herein set forth, we warrant that the seeds or bulbs sold are as described on the container, within recognized tolerances. Our liability on the warranty is limited in amount to the purchase price of the seeds or bulbs. In no event shall be liable for the crop, or for any loss due to the failure, impairment or quality thereof or varietal variance therein, whether such loss results from breach of the foregoing warranty, from breach of any other provision of the buyer's contract for purchase of said seeds or bulbs, or from any other cause.

Fred C. Gloeckner & Company, Incorporated

15 EAST 26th STREET, NEW YORK 10, N. Y.

LExington 2-4197 At Madison Square

LATEST DEVELOPMENTS IN GREENHOUSE COOLING . . .

Cooling of greenhouses throughout this country has occurred in an amazingly rapid manner and because of this, much has been learned about practical installation within the past year. Because of the many different types of installations, the variation of local climatic conditions, and the way in which individual crops respond to air conditioning, there are many opinions on this subject. Listed here are some of the major factors that can be emphasized.

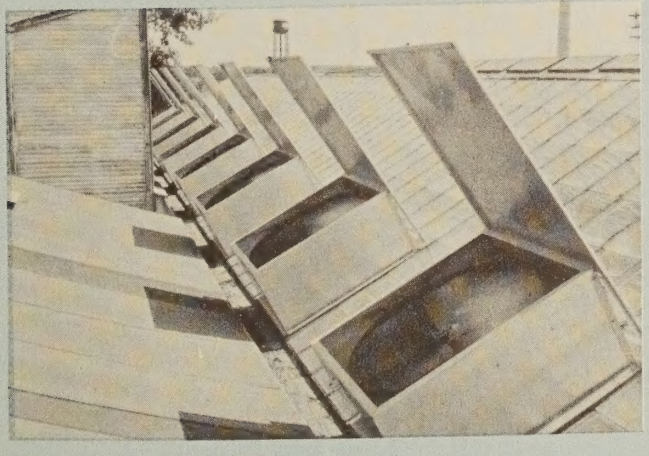
1 **Provide plastic baffles** to direct air movement. Polyethylene film suspended from the gutter-line to the uppermost point of the ridge, is recommended every 30 to 40 feet. Likewise, when pulling air across a ridge and furrow range, the use of plastic baffles extending down from the gutter two feet or so and running the full length of the greenhouse is practical in some cases. This will keep the air moving closer to the plants and will leave an undisturbed layer of warmer air in the ridge of the greenhouse. The use of baffles will also tend to increase the velocity of air moving through the greenhouse, which is desirable.

2 **Distribution of water** and the wetness of Aspen pads is greatly emphasized. Dry areas in the pad greatly reduce pad efficiency. Many times pads are wet only on one side. This should be corrected. The installation of a large enough pump to keep the pad thoroughly saturated is of extreme importance. Keep the water level in the drip conductor as high as possible.

3 **Pads are sometimes too thick.** A person should be able to barely see through a pad if he stands with his face against it.

4 **Keep pads free from excessive dust,** dirt, cottonwood seed, and accumulated salt from the water. An occasional hosing of the Aspen pad with a strong rose syringe will keep the pad operating efficiently.

5 **Withhold water from the pads,** growers in areas of high humidity have learned, when the sun goes down, turning it on in the morning. In this way, condensation problems can be held to a minimum if not eliminated.



Roof installation pulling air across a ridge and furrow range.

Same installations as left, showing the use of baffle in house where fans are mounted.

GREENHOUSE COOLING—*Continued*

6 **Feeding programs** have been increased under air conditioning. Denver growers in some cases have doubled the amount of fertilizer applied in regular watering methods, to compensate for the increased, lush growth. While the frequency of watering is decreased, growth is increased.

7 **A light shade is recommended** over blooming carnation stock. A light shade not only increases flower size, but adds flower color. With cooler greenhouse temperatures, this light shade will not impair production because there is an abundance of plant food manufactured under the cooler conditions.

8 **Insecticide-sprayed** aster cloth can be suspended several feet away from the pad and enclosing it. This impregnated cloth not only will hold thrip infestation down, but will filter out flying seeds and leaves. The cloth can be re-sprayed when necessary.

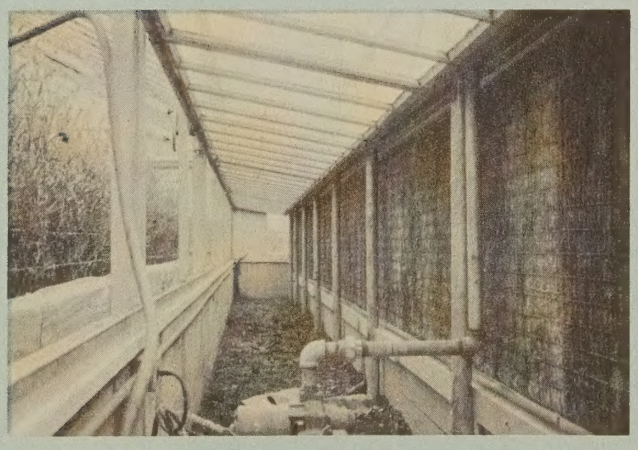
9 **Wind breaks** have been suggested for greenhouses where the fan must be on the side of a strong prevailing wind. By erecting a barrier 10 to 15 feet away from the fans, much of the direct force of the wind can be eliminated.

10 **The use of a detergent** as an additive to the circulating water in many areas helps to wet the pads with greater penetration. Tide, Liquid Lux or a similar material is used. Copper sulfate, when added to the sump, will retard the rotting of Aspen excelsior and keep algal growth down. Small amounts are effective. One cupful per 50 gallon tank is effective for a week or so.

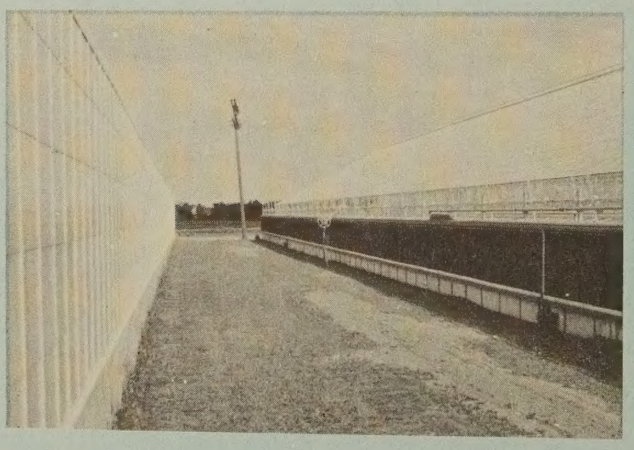
11 **Do not over cool your greenhouse.** Recent studies from Colorado A & M show that too low a daytime temperature will retard carnation production and yet will not increase quality. Now that summer temperature control is possible, research will show the proper temperatures at which to get the best production and yet maintain maximum quality. Daytime temperatures below 75° in the summer are not recommended.

12 **Early spring and late fall operation** of air conditioning has been beneficial. Northern growers who have started in April and May with part of their fans report good results. Installations that were closed by September 1, showed a noticeable drop off in quality by October 1, due to spotty hot weather in the fall.

13 **Employ a licensed electrician** in providing power to the fans. Even though there are many handy greenhouse operators who can do an excellent job of installing air conditioning, the important task of wiring should be left to one qualified for the job. By the time an average-sized range is cooled, the power load is great. Remember that the fans in most cases will operate twenty-four hours a day all summer long.



Above, as side vent is raised it makes air tight chamber with pad.



Same installation as left from exterior.

GREENHOUSE COOLING—*Continued*

14 Pull air the length of the greenhouse. The advantage of air conditioning greenhouses is now an established fact with most growers. With those who are contemplating putting it in, the major question is which way to pull the air. Until recently it was believed that either a lengthwise or crosswise flow of air were equally effective. However, now the advantage of increased air velocity, with the same number fans, has clearly pointed to the importance of this subject, and pulling of the air the longest way seems best. For example: if the greenhouse range to be cooled is comprised of two 35-X-150-foot houses it would be better to pull air lengthwise rather than across them, everything else being equal. The air will then move over the plants almost twice as fast.

HIGH PRESSURE MIST PLUS FANS

The system incorporating high pressure mist with fans, while still new, appears to have some benefits over the pad and fan system.

Preliminary investigations seem to indicate that high pressure mist operated in conjunction with fans has the following advantages:

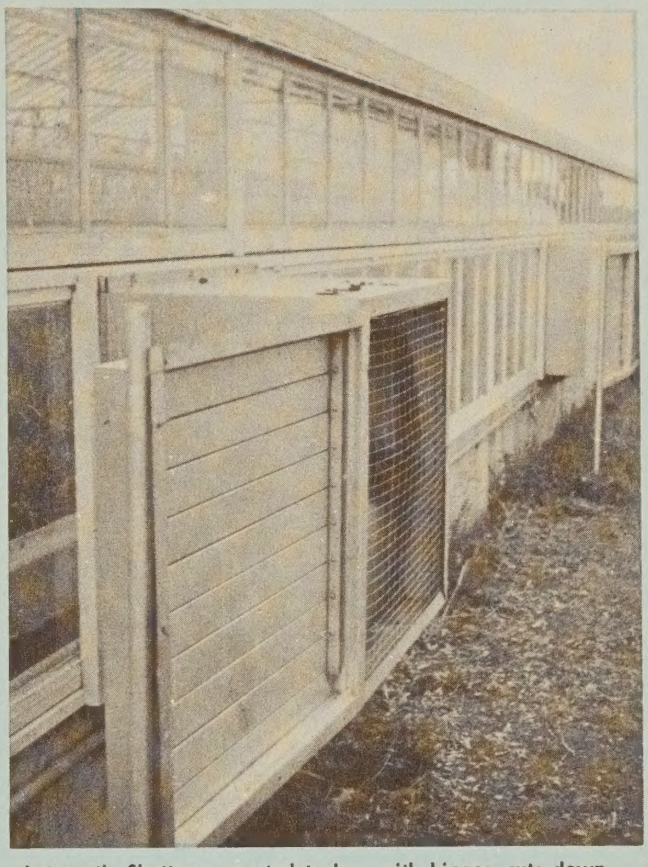
1. Under extreme high temperatures, the possibility of maintaining slightly lower temperatures and higher relative humidity is possible.

2. It is more adaptable to greenhouses where adequate pad area is not available. In houses over 200 feet long, efficient control of temperature throughout the house is no problem. It is more easily adaptable to houses of varying types and sizes and "tightness" of the house is generally considered less important than with pad installations although undoubtedly tightness will make the system more effective.

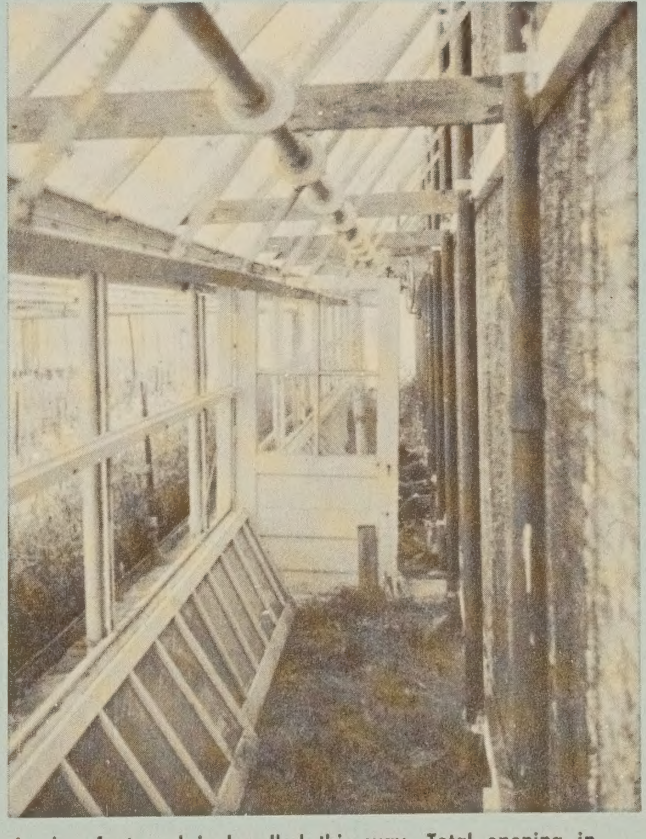
3. Once the installation is made it is permanent. Over a long period of time, with large installatons, the combination system will undoubtedly be comparable and possibly lower in cost than fan and pad installations. Early replacement of Aspen pad is not necessary.

4. Year-round operation is possible under the combination system where it is not with the pad system.

5. Uniform temperatures throughout all areas can be maintained.



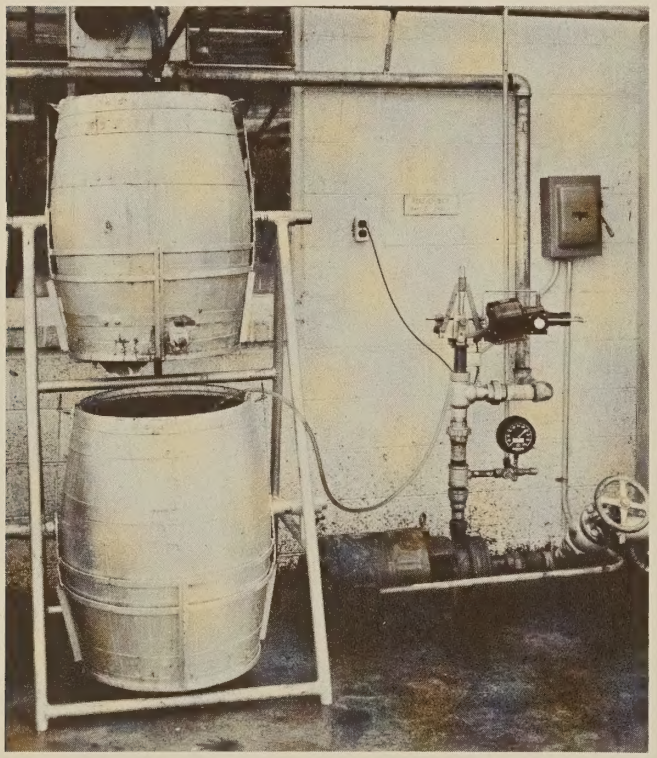
Automatic Shutters mounted to box with hinges, cuts down air resistance when shutters aren't needed.



A nine foot pad is handled this way. Total opening in side wall is only 4 feet.

NEWEST METHOD OF LIQUID FERTILIZING

The benefits of liquid fertilizing have been clearly pointed out in the last several years. Pot plant growers in particular are finding it possible to feed much more often than they could afford to under the old system of applying dry fertilizer. Most growers heartily endorse liquid feeding, but usually find that it is a cumbersome procedure. Up until now much of the equipment available to the trade for injecting or proportioning fertilizer into a water line has either been undependable, too complicated, or too costly. The FERT-O-JECT is the first reasonably priced unit designed to inject fertilizers into a water line without cutting the water pressure. This unit, designed and developed expressly for work with fertilizers, is precision built, yet any grower can tear it down and reassemble it.



Fertilizer injector set up which injects liquid fertilizer concentrate into water line.

HOW FERT-O-JECT WORKS

Fertilizer is injected into the water line by **positive displacement** and does not use a diaphragm or complicated linkage. The FERT-O-JECT operates with an **Automatic Flow Rate Anticipator.** Regardless of the number of people watering or the volume of water being used, the correct amount of feed is injected into the system. The accuracy of the FERT-O-JECT is truly amazing. The unit automatically turns off when the watering is finished.

Growers throughout the country are liquid feeding very weakly every time they water. This system was advocated by W. D. Holley of Colorado A & M several years ago and many growers in the Colorado area have been feeding in this manner. This popular system has been spreading rapidly, with other universities and authorities recommending its use.

METHOD IS PRACTICAL

Perhaps the statement that most clearly emphasizes the practicalness of feeding weakly with every watering is: "The rate a plant uses water is the best available measure of its fertilizer requirements". A plant is constantly using fertilizer so it is therefore feasible to assume it is right to feed it constantly. In the winter months, plants are watered less and consequently receive less feed. Cutting benches, shaded areas, and cooler crops receive less water and therefore less feed.

Major results are observed in nutrient levels after such a method of fertilizing—mainly soluble salts drop and other nutrient levels remain very constant.

The labor involved in applying and watering-in dry feed, while not a major item, can be eliminated and at the same time a more dependable and a more uniform application of fertilizer will result.

The switch from a weak fertilizer to clear water can be made by simply turning one water valve.

The fact that fertilizer stands in the water lines scares many growers, but the solution is so weak that water systems twenty years old are not affected when a new unit is installed.

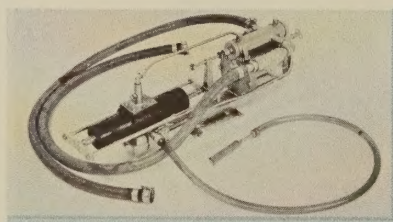
APPLICATION RATES

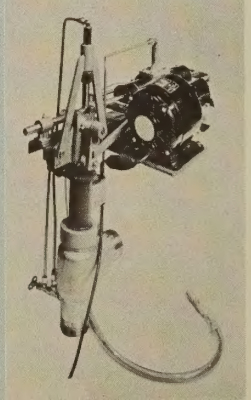
The amount of fertilizer used with the FERT-O-JECT will of course vary with the grower, locality, and crop, but many growers are putting 50 lbs. of ammonium nitrate and 30 lbs. of muriate of potash per barrel, which in turn makes 10,000 gallons of weak fertilizer. All FERT-O-JECT, MODEL E's, are set at the factory at a proportion of 1:200. Any soluble fertilizer can be used with the system.

With the advent of satisfactory surface watering systems, liquid feeding regularly is even more important. These newer watering systems do such a satisfactory job of watering that more fertilizer is leached from the soil.

Growers have successfully grown chrysanthemums, roses, and carnations at the same range with one FERT-O-JECT and one fertilizer formula.

The simplicity and accuracy of the FERT-O-JECT, make it a popular piece of equipment with growers once they see it operate.





(Above) Portable Fert-O-Ject, Model PR, for pot plant growers. Proportion 1:35. $235 F.O.B. Whittier, Calif.

(Right) Fert-O-Ject, Model E, for permanent installation seen in the large photograph above. $435 F.O.B. Whittier, Calif.

DIRECT BENCHING AND ITS MODIFICATIONS

Production costs are continuing to increase and returns are not keeping pace, so it behooves the producer to eliminate costs wherever possible. With this in mind, many growers of carnations are eliminating the time taken in producing young plants. This has been done with good success by direct benching of rooted cuttings. Direct benching does away with either one or two transplanting processes, depending upon the method used. Many months of preliminary growing are eliminated through properly timed propagation. The key to the success story of direct benching of rooted cuttings is that plants grown this way are never retarded in growth, have less chance of becoming diseased, break more freely and grow faster than when handled by any other method.

The problem that results from direct benching is the time the plants occupy the bench before production starts. Some growers feel that planting rooted cuttings in January or February will give them higher quality flowers for June and July production. This allows them to start removing the old benched plants in June. This procedure allows producing plants to remain in the benches eighteen months before replanting. It would also result in good production the year around.

CHANGES IN PROPAGATION

Heavy cuttings are rooted as needed, and timed so that they are ready to plant direct in the bench as soon as it is cleared of a previous crop and the soil readied for planting. This eliminates the older method of taking cuttings in January and February, rooting them, placing them in four-inch pots and later benching in May or June. The cuttings must be **vigorous, plump and free from disease** — the kind that can best be secured from strong, healthy mother block stock plants. For direct benching, strong top cuttings are superior to heel cuttings.

PLANTING TIME

Direct benching of rooted cuttings has proven best when carried out from January to June. The optimum time is during March, April and May. However, in California direct planting has been successful any month of the year. **Never plant the cutting any deeper than it was in the propagating media, since stem rot organisms can readily enter any tender stem tissue when it is placed below the soil surface.**

Some growers who have had difficulty with losses from Rhizoctonia as a result of deep planting have successfully used peat pots as a means of reducing these losses. Rooted cuttings are planted in the pots using a light, porous soil mixture. Usually a first pinch is given before the plants are benched. When benched, about ½ to one inch of the pot is allowed to remain above the soil, thus reducing losses from Rhizoctonia. This practice has been very successful on varieties other than Sim, which are sometimes more susceptible to stem rot organisms.

SPACING

When planting Sim varieties, we suggest that you plant approximately 20 per cent closer. This group of varieties does not grow as bushy as other varieties. We feel that it is better to place more plants across the bench but keep the rows eight inches apart down the length of the bench.

(Continued)

Direct benching of rooted cuttings.

Watering in newly-planted cuttings.

DIRECT BENCHING AND ITS MODIFICATIONS—*Continued*

PINCHING

After the cuttings have been benched three to four weeks, they are ready to be pinched. Carnation plants will often begin to break before they are pinched. After the top of the cutting is pinched out, the side shoots or breaks develop and elongate at a fast rate. The pinch **must be made high** to insure enough breaks — merely remove the tip of the young plant. However, if a newly-benched rooted cutting should develop a flower bud immediately after benching, then a fairly deep pinch should be made so that all new breaks are vegetative.

PINCH AND A HALF

To avoid heavy cropping at one time, some growers pinch half of the shoots that develop after the first pinch. The second pinch should be delayed until after the shoots are 8 to 10 inches long. This method is referred to as a pinch and a half and is readily accepted by retail growers. This second pinch is only done on the more vigorous varieties and will break up the crop resulting in a more continuous cut.

The pinch-and-a-half method is likely to fit into two-year culture, with the possibility of replanting half the carnation space each year with rooted cuttings, and continuing the other half for late spring and summer production. Since good disease control is an essential of two-year culture, the method is particularly well suited, since there is less likelihood of contamination when cuttings are benched direct.

The grower of miscellaneous crops, wholesale or retail, usually can rotate carnations with other crops and thus have benches free by mid-May or early June. Carnation cuttings should be placed direct in these benches and it should still be possible to cut carnations from the old crop in other benches. If carnations are a minor crop, it might be advantageous to eliminate all the chores and worries of propagation and care of young plants and procure strong, clean-rooted cuttings from a propagation specialist on a specified planting date. The time and space required for home propagation and growing on can be put to use profitably on other crops, thus offsetting the costs of procuring cuttings.

OBTAINING LATE CUTTINGS

Direct benching of rooted cuttings necessitates some changes in propagation schedules, with a need for cuttings in late spring in addition to the customary midwinter supply. To assure availability, growers should make arrangements as far in advance as possible to order cuttings. Most propagation specialists are preparing for this demand, and our representatives are informed as to the varietal availability through the late spring months.

MODIFIED DIRECT BENCHING

Since some growers might not wish to throw out their producing carnations until the end of June or early July, a modification of the direct benching has been carried out. This modification consists in banding the cuttings for a short time, possibly only six weeks. The cuttings are propagated in early May, placed in 3x3x3 bands, pinched thirty days after banding, and then benched in late June. Still another method is to plant rooted cuttings into outdoor beds or benches, pinch once and plant inside when time permits. It is necessary to plant the cuttings in sterilized soil to insure a disease-free condition. This past year one grower had good success when he planted rooted cuttings into a raised bench outdoors the first week of June. The plants were pinched July 1 and the young plants were benched in the greenhouse in mid-July. Keeping the plants outdoors only a short time resulted in a stocky growth and also permitted the removal of the old plants before the young plants became too hard.

Heavy branching from a single pinch made high on a strong, actively growing young plant.

NO-PINCH METHOD

Quite a few growers who have practiced direct benching favor the no-pinch method. The plants are allowed to grow and produce one bloom per plant before they are topped. When cuttings are planted during winter and early spring, the first bloom is of exceptionally high quality. The breaks appear before the bloom is cut and little difference can be detected from the usual pinched plant.

DIRECT BENCHING AND ITS MODIFICATIONS—*Continued*

FERTILIZING

Excellent results have been obtained by applying a half-strength liquid feeding three to five days after benching. Subsequent feeding and watering should be adequate to maintain active, vegetative growth constantly. It has been found that weak liquid feedings applied every two weeks during the bright weather is considerably better than heavy feedings once a month. We also feel that to grow good carnations the growth must be kept soft and lush. **Never** check the growth of a carnation plant. During the early growth of the plants a water soluble fertilizer high in nitrogen should be used. Any fertilizer having an analysis of 10-10-10 or above is satisfactory, and may be used at the rate of 2 ounces in 6 or 7 gallons of water.

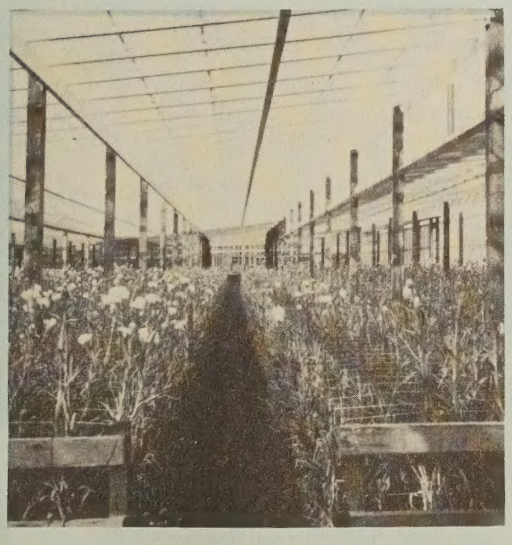
CROPPING TIME

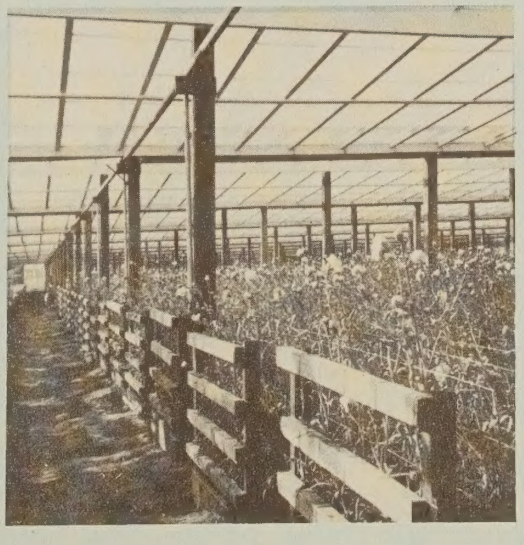
Information on cropping time is still not complete, but it is more apparent that with increased experience timing will be more accurate than with other methods of growing. One reason is that the first flowers from a single pinch tend to be grouped more closely than when plants have been pinched several times. The subsequent crops are more scattered.

The comeback with the single pinch method of growing has been more rapid than with other methods, especially with Sim varieties. On a number of varieties, the second-crop shoots have reached considerable length before the first crop is cut. This comeback rate is significant in achieving a good total production yield. One of the country's outstanding carnation research men has this to say about production with the direct-benching single-pinch method: "We do not think we are sacrificing production and are certain that the production obtained can be timed for best market periods more accurately."

ADAPTING THE METHOD

Many possibilities for adapting the method to commercial production already are being used. In ranges where culture is always under glass, no adaptation problem exists. Rooted cuttings can be benched as late or later than young plants that have been propagated much earlier and held in pots, bands, flats or transplanting bench. Experience has shown that rooted cuttings, unchecked by extra transplanting, hardening, crowding, etc., move off faster and catch up with plants propagated as much as three months earlier. A major advantage resulting from direct-benched cuttings is that they break more freely from a single pinch. In ranges where outdoor culture is practiced, adoption of the new method, means removing the old crop from bench after Mother's Day, Memorial Day, etc. Since the demand for some colors (primarily red) decreases sharply in warm weather, it should not be a handicap to throw out some crops and rebench direct with rooted cuttings during May and June. Advantages gained include reducing the amount of field planting, cultivating, lifting and benching heavy field plants, all of which are laborious and costly procedures.





Direct Benching in Southern California in New Type Greenhouse. Open Ventilation — No Heating.

BETTER CARNATIONS

Good quality carnation cuttings will produce good carnation plants. Freedom from disease, plump, vigorous growth and trueness to type are three essentials of good rooted cuttings.

FROM FLOWERING PLANTS

Most commonly, cuttings are taken from flowering plants. Where extreme care is exercised in selecting cuttings, varieties can be maintained reasonably free from disease and will compare favorably to the original standards of the variety. More often, though, selection is not practiced to the required degree, and varieties deteriorate and sooner or later must be replaced. Selection, when taking cuttings from flowering stock, is laborious because of the large number of plants that need to be examined to obtain a sufficient number of good cuttings.

In selecting cuttings: (1) avoid grassy growth; (2) choose vigorous, plump shoots; (3) avoid diseased plants; (4) take cuttings from plants bearing flowers of good color, form and fullness.

Strong, well-rooted cuttings.

MOTHER BLOCKS

Mother blocks of stock plants are more satisfactory sources of good cuttings than are flowering plants. Consistent users of the mother-block system feel that the advantages outweigh the disadvantages. The method is used extensively by most propagation specialists. Mother blocks are grown for the sole purpose of producing cuttings. Potential flowering shoots are pinched back to force more breaks for cuttings, although one shoot per plant may be allowed to flower early in the season to verify the plant for flower type and color.

Since each plant in the mother block will produce numerous future cuttings, extra care is taken to select and maintain clean, vigorous and true-to-type stock in the mother block. Plants going into the mother blocks are kept under glass at all times.

The only disadvantage of the mother block system is that the bench space occupied does not produce flowers for cutting. However, over a period of time this is more than offset by the production from the flowering plants that are propagated from vigorous, healthy cuttings taken from mother block plants.

CULTURED CUTTINGS

In many cases, laboratory methods are used to produce "cultured cuttings." The results have been satisfactory in controlling two major carnation diseases, fusarium wilt and bacterial wilt. Culturing is a job for the specialist, and is not adaptable for every range. In the procedure usually followed, laboratory culturing is used to procure clean mother stock or foundation stock, rather than culturing of each individual cutting that will be benched. Additional laboratory methods are in the developmental stages for similarly procuring virus-free foundation stock. Cultured stock, free of certain diseases, can be recontaminated or reinfected. **Culturing does not develop resistance to disease.**

DISEASE FREE CUTTINGS

A recent and promising development in assuring clean stock to start with is the program to grow propagating stock, never contaminated, under isolated conditions. From the start young seedlings of potential new varieties are grown entirely apart from carnation contaminating sources. Since the carnation diseases, including viruses, are not transmitted by seed, it is possible thus to start with a clean cutting. Maintaining clean stock from that point on hinges on complete isolation and rigid sanitary and preventive controls. The disease-free cuttings resulting from this technique are not necessarily disease resistant, so the individual grower receiving these will wisely institute the best control methods available to him in order to keep such stock as clean as possible for as long as possible. Since the development of assured sources of disease-free cuttings, individual growers have turned more and more to propagation specialists for annual renewal of their stock.

PROPAGATION PRACTICES

Carnation cuttings root readily enough with average care, but the grower who does not utilize every known precaution of sanitation and fails to give expert attention to his propagation is jeopardizing his entire next year's production of carnations.

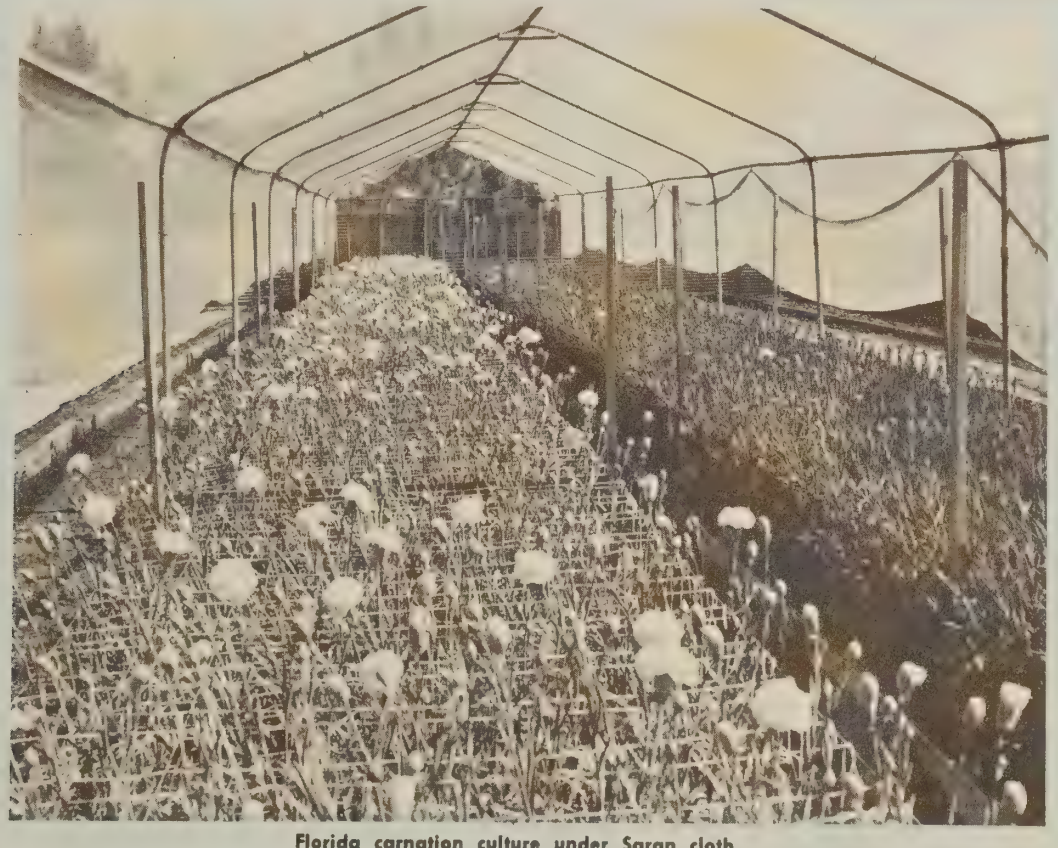
TIME OF PROPAGATION

The propagating season normally extends from November to March, with most cuttings made during December and January. The trend now is to propagate later, or at least to lessen the time between rooting and benching the plants in their ultimate location. The advantages of early propagation in "building a bushy plant" are more than offset by the checking of growth, hardening, crowding and the ever present disease problems when plants are held too long before final benching or going to the field. As reported earlier in this Manual, rooted cuttings benched direct make extremely vigorous growth and usually overtake older plants from winter propagations.

CUTTING TECHNIQUES

In order to obtain the best carnation plants, two specific goals should be kept in mind when propagating carnations: (1) Root the cuttings quickly and place them in the soil as soon as possible to avoid hardening or checking the growth; (2) Observe every precaution to prevent disease contamination or spread. To accomplish these objectives the following procedures are suggested:

1. **Use only large, vigorous and disease-free cuttings.**
2. **Break, do not cut, cuttings from the plants.**
3. **Do not cut the bottoms or trim the tops of the cuttings with a knife. (High humidity must be maintained and cuttings may require a little more space in the sand if they are untrimmed. However, they will root more quickly and are less likely to become infected with disease.)**
4. **Dip the lower end of cuttings in Fermate. Do not throw them into a Fermate solution since this provides an excellent opportunity for the spread of bacterial wilt. Some growers prefer to blow Fermate dust onto the cuttings with a puff duster.**
5. Use perlite in a sterilized propagating bench.
6. Maintain 60 to 65 degrees F. day and night for rooting.
7. As soon as the roots are ¼-inch long, remove cuttings from the sand and plant them in soil. Do not let the cuttings stay in the sand to develop a massive root system since this will result in hardened plants.



Florida carnation culture under Saran cloth.

CARE OF YOUNG PLANTS

The idea that young carnation plants must be hardened to achieve quality is not true. All the research is in favor of maintaining an active growth, by both the root and top. If this means later propagation or greater spacing of your plants, or both, the ends justify the means. Checked plants are a long time recovering, and they never completely outgrow damages suffered in the early stages.

As soon as the cuttings are rooted they should be planted in soil — in bands, pots, benches or flats. Advocates can be found for each of these methods, and subsequent handling frequently determines which method will be used. Because of the restriction to root action which results in hardening the plants, potting in 2¼'s is losing favor. Bands have a greater soil capacity than pots, and while they also restrict root action to some extent, they have the advantage of less disturbance to the roots in later transplanting than is the case when young plants are placed in flats or benches. Spacings of 3 x 4 or 4 x 4 inches in benches or flats is preferable to closer spacing, since the plants do not ordinarily require a great deal of room before the final benching indoors or going to the field. (For direct benching of rooted cuttings see the special text starting on page 5.)

Use a good potting soil mixture or bench soil mixture for the young plants, containing about one-fourth peat or well rotted manure. Sterilizing the soil, as well as pots, flats or benches is highly advisable. If steam is used rooted cuttings may be benched immediately after steaming with no harmful effects and with a saving in time of 2 or 3 weeks.

After the young plants are established, frequent light feedings with a liquid fertilizer aid in keeping the growth active, particularly where the plants are confined in pots or bands.
Insect and disease prevention are vital at this stage. Remember the crowded conditions under which young stock too frequently is grown makes the spread and increase of pests easy.

In planting or transplanting cuttings or young plants **always plant shallow**, or, never deeper than they had previously been set in sand or soil.

SOILS AND FERTILIZERS

Carnations grow well in a wide variety of soils, but fibrous loam soils which remain reasonably porous and permit free drainage of surplus water throughout the growing season are easiest to manage. Blue grass sod, to which rotted manure has been added plus an application of superphosphate, gives uniformly good results. Since the average carnation crop will be in the bench about a year, attention and time put on good soil preparation before benching are both necessary and justifiable.

STEAM STERILIZATION

Carnations can be grown year after year in the same soil if it is thoroughly steam sterilized annually and the organic matter is replenished. Steaming is a dependable method of eliminating soil-borne carnation disease organisms both from the soil and the bench boards. Some growers even sterilize new soils, calculating that the disease-control insurance and the killing of weed seeds justifies the additional cost.

Results on steam-sterilized soil are comparable to those on good new soil, if all of the rules are followed. To avoid some possible pitfalls, the following practices are suggested:

1. Reduce nutrient levels and soluble salt content of the soil prior to sterilization by keeping to a minimum the late feedings on the previous crop. Also the last one or two waterings of the preceding crop can be much heavier than usual to accomplish leaching prior to sterilization. Have a soil test made by your state soil laboratory or horticulture department.

2. Add organic matter to the soil liberally before sterilizing — about one-fourth by volume of rotted manure, chopped legume hay or peat-moss.

3. Steam sterilize the soil so that a minimum of 180° F. is reached and held for thirty minutes in every part of the bench soil. There is a growing tendency by many growers to steam for a longer period of time in order to make certain the fact that all parts of the bench are thoroughly heated to 180° F.

4. It has been customary to wait one or two weeks after steam sterilizing before planting. At present it is much better to plant as soon as the soil has cooled off. It has been found that the nitrate concentration gradually increases during the first two weeks after steaming, and if we wait two weeks before benching we are planting when the concentration of salts is the highest, and considerable root loss will occur. When we plant immediately after steam sterilizing and then water heavily, the plants become established before the nitrate concentration becomes excessively high. The second watering should be heavy enough to leach out most of the accumulated soluble salts resulting from steaming.

5. Apply 5 pounds of gypsum (calcium sulfate) and 5 pounds of superphosphate per 100 square feet of bench space, and mix them into the soil thoroughly before planting.

6. Do not use a complete fertilizer at benching time, but wait until after the plants are established and growing. A half strength liquid feed may be applied three or four days after benching to help give the cuttings an additional fast start.

7. After the original watering-in of newly benched plants, do not let the soil become hard and dry before giving the second and subsequent thorough watering.

OTHER STERILIZATION

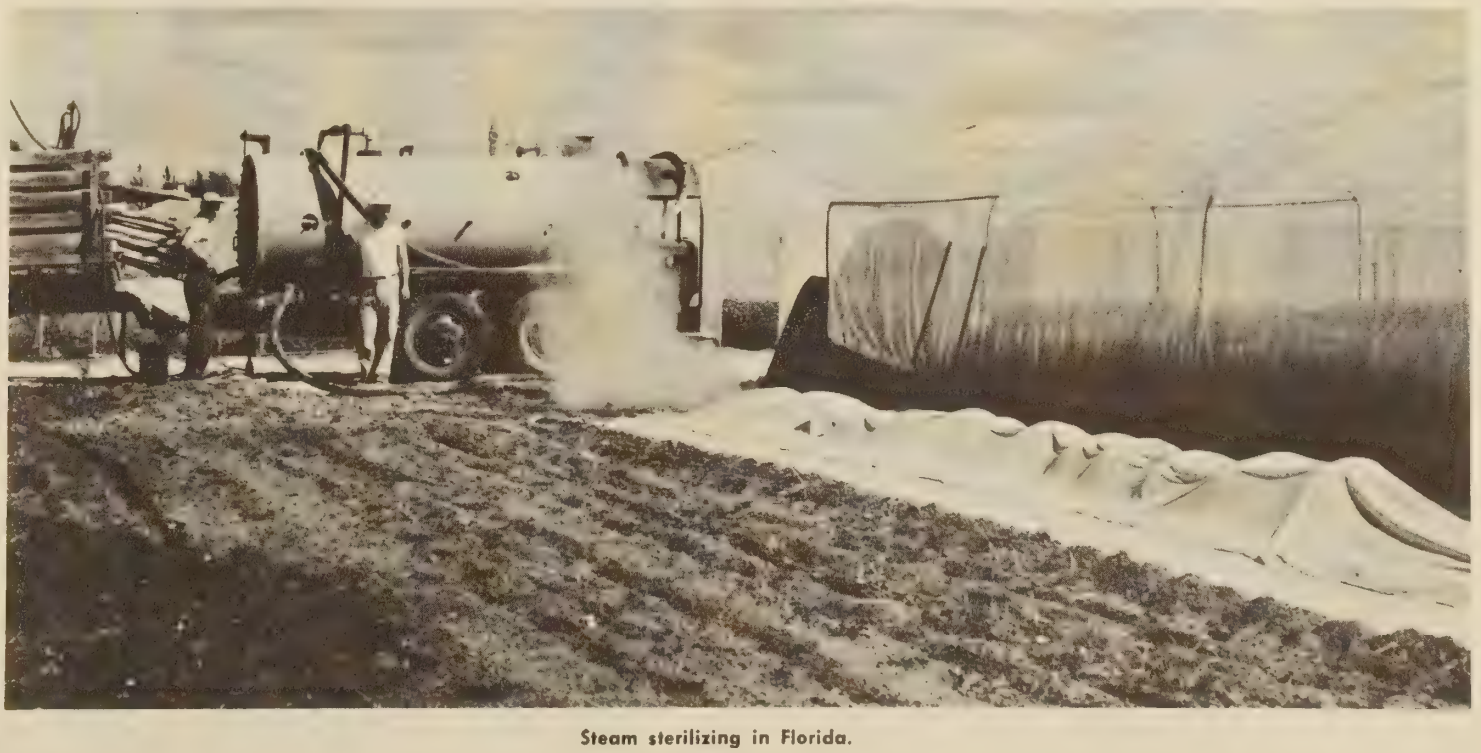
Chemical sterilization of carnation soils is receiving a great deal of attention, and some soil fumigants and chemicals are useful in the control of specific disease, insect and weed pests. For all-round effectiveness, steam sterilization still holds the No. 1 position.

Hot water sterilization is used by growers to some extent, and in some areas it is preferred to steaming, probably because the extremely large volume of hot water used to achieve sterilizing temperatures accomplishes something in leaching not ordinarily achieved with the steam method. For thorough sterilization with hot water, the minimum temperature of 180° F., held for thirty minutes, must be satisfied.

NEW SOIL

When sterilizing is not practiced, new soil may be brought in for each successive crop of carnations. Avoid reusing soil that has grown carnations during the previous five years. A good sod soil is superior to field soils that have been in cultivation. Mix about one-fourth by volume of manure, peat or chopped legume hay with the soil. Also incorporate 5 pounds of superphosphate per 100 square feet of bench space before planting. Complete fertilizers are better withheld at benching time, but they may be applied after the plants are established, unless soil tests show decided deficiencies in nitrogen or potassium. The young plants generally start off more rapidly in a lean soil, and are then soon ready for feeding.

(Continued)



Steam sterilizing in Florida.

SOILS AND FERTILIZERS—*Continued*

IMPORTANCE OF DRAINAGE

Perhaps one of the most important factors to be considered before placing new soil in benches or steaming old soil is that of providing adequate drainage.

Poor drainage can result in poor aeration, build-up of soluble salts and increased stem and root rot disease troubles.

Before placing new soil in raised benches that have wood bottoms, make sure that all cracks are free from encrusted salts or old roots and other debris. With corrugated transite bottoms, it has been found necessary to drill three ⅜-inch holes across the width of a 4-foot bench and every 3 feet down the length. The holes have not weakened the transite in any way.

Approximately one inch of medium coarse gravel should be spread evenly on the bench bottom. On top of the gravel place about one-half inch of coarse sand, after which the soil mixture may be added.

If you are growing in ground beds a single line of 4-inch tile should be set at a depth of about 15 inches below the soil surface. The tile should empty into an area outside the greenhouse.

Many times excess soluble salts accumulate during the summer months when fertilizer applications are heavier. Entering the darker months, a thorough leaching of the soil is usually beneficial to remove these excess salts. In most sections of the country, November is a good leaching month, with a switch to a winter feeding schedule higher in potash bebinning December 1.

An adequate drainage condition in the bench will permit leaching without any damaging effects, since the excess water rapidly drains from the soil allowing faster drying of the soil in the cooler months.

MAINTAINING FERTILITY

Plant growth and appearance are good guides to fertilizer requirements. Monthly soil testing of individual benches likewise is a valuable aid. A combination of the two is the best thing available in planning the fertilizing program.

Soil tests (Spurway) should show about 15 to 25 p.p.m. nitrate nitrogen; 5 to 10 p.p.m. phosphorus; 20 to 40 p.p.m. potassium, and about 200 p.p.m. calcium. To increase the nitrate level, fertilize with sulfate of ammonia at the rate of 1 pound per 100 square feet. Growers who have an acid soil should use nitrate of soda which leaves an alkaline residue that will help to raise the pH more toward 6.5. Frequently the original incorporation of superphosphate in the soil before benching is adequate to maintain phosphorus levels for the season. If not, superphosphate can be applied in a supplementary way at the rate of 3 to 5 pounds per 100 square feet. To raise the potassium level, muriate of potash can be applied at the rate of 1 pound per 100 square feet. To raise the calcium level, gypsum (calcium sulfate) may be applied at the rate of 2 to 3 pounds per 100 square feet.

Growers may find it desirable to use complete fertilizers instead of the single-element fertilizers mentioned above. These can be obtained in different combinations and may be applied dry or as liquid feedings. Liquid feeding is increasing in popularity because of the laborsaving in application, more even distribution of food to the plant roots, and faster response by the plant.

Frequent light feedings are safer and preferable to heavier feedings spaced farther apart. Remember also that plant requirements are less during the slow-growing dark winter months than during the periods of rapid growth in spring and fall. In the summer months growth may be rapid, but the high soil temperatures cause speedy breakdown of organic matter in the soil, releasing considerable quantities of nitrogen in this process. Thus excess fertility, particularly nitrogen, can occur at that season. However, recent experiences have indicated that a program of liberal feeding, accompanied by liberal watering during the summer months is advisable from the standpoint of maintaining active growth and keeping the plants vegetative. In timing fertilizer applications, allow for two or three week's lag between application and the beginning of response in the plants.

Excess fertility is not uncommon. When plants stand still, show no new root action and appear yellowish and stunted, excess soil fertility is a likely cause. Thorough leaching is the corrective measure. We recommend (1) a normal watering so that water just drips through the bottom of the bench, followed three or four hours later by two or three extremely heavy waterings that bring the water streaming through the bench bottoms.

SOILS AND FERTILIZERS—*Continued*

SOLUBLE SALTS

Soluble salts are chemical compounds consisting of an acid part or ion and a basic ion. For example, common table salt, sodium chloride, consists of one ion of chloride and one ion of sodium. Chloride is an acid forming ion and sodium a basic or alkali forming ion. The two combine in chemically equivalent quantities to form a neutral salt. Other common acidic ions are sulfate, nitrate, bicarbonate, and phosphate. Other common basic ions are calcium, magnesium, potassium and ammonium. Any basic ion may combine with any acidic ion giving rise to a great variety of salts.

All plant nutrients which are absorbed by plants from the soil or from culture solutions are absorbed in the form of salts or their constituent ions. All organic materials become "mineralized" through decay processes and the nutrients in them are converted into salts before being absorbed by plants. Some salts contain plant nutrients and are beneficial in the small quantities required for plant growth. Others contain no nutrients. All salts are harmful beyond the small quantity required for plant growth. A little is bad, more is worse, up to the point where plants will be killed. Salts are found in most water and are applied as fertilizer. Improper watering or poor drainage may permit a concentration into the harmful range.

Instruments called Wheatstone's bridges are available which measure total soluble salts in terms of electrical conductivity or conductance. Many laboratories of the Agricultural Extension Service are equipped with Solubridge instruments for use in assisting with soluble salt problems.

It has been found that when planting rooted cuttings, the Solubridge readings should not be higher than 40 while established plants will not withstand readings of 100 without showing some harmful effects. To remove excess soluble salts apply two to three galllons of water per square foot and leach out this high salt content.

ACIDITY

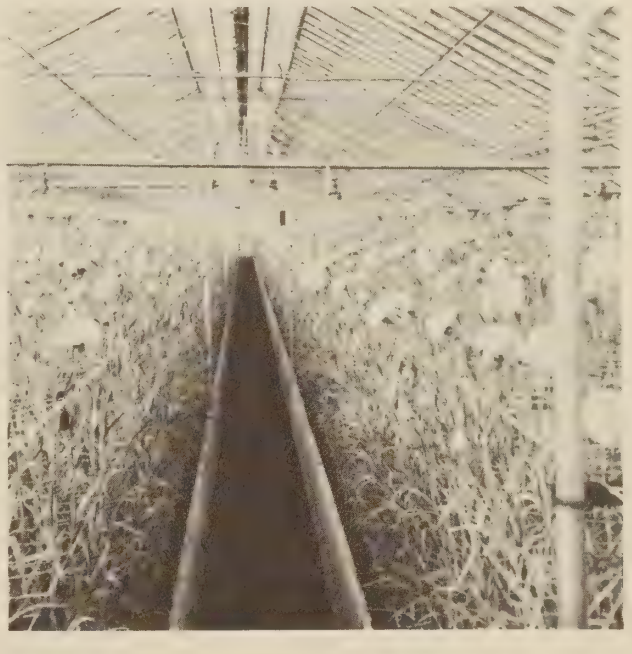
Soils testing near neutral in reaction (pH 6.5 to pH 7.0) are considered desirable for carnations. However, good carnations can be found growing in a range of pH from 6.0 (acid) to 7.5 (alkaline). Hydrated lime and ground limestone are used at rates of 2 to 5 pounds per 100 square feet when soils are too acid, and sulfur is used at 1 to 2 pounds per 100 square feet when soils are too alkaline. Since the reaction is slow in both cases, it is desirable to incorporate these materials, thoroughly, into the soil in advance of planting, if tests show they are needed as corrective measures. these for carnations is questionable. Where the mulch is confined to a strip eight or ten inches wide along the south side of a bench, it may reduce the need for touch-up watering in that exposed area during hot weather.

CULTIVATION

Carnation plants have numerous feeder roots near the surface of the soil. If cultivation is used at all, it should be shallow and confined to scraping off weeds that germinate in benches of unsterilized soil. It is much better to depend on good advance preparation of soils to keep them open than to cultivate later to loosen them. If there are a great number of weeds in benches that have been steam sterilized a closer check should be made on temperature during the steaming process since 180° F. will definitely kill all weed seeds present in the soil mixture.

MULCHES

Light mulches of rotted manure, corncobs, spent-hops, buckwheat hulls, peat, etc., are sometimes used during late spring and summer. The value of these for carnations is questionable. Where the mulch is confined to a strip eight or ten inches wide along the south side of a bench, it may reduce the need for touch-up watering in that exposed area during hot weather.



Carnation stock plants.

OUTDOOR vs. INDOOR CULTURE

Outdoor or field culture during the spring and summer months still is practiced extensively. The trend, though, is toward indoor culture, or keeping the plants continuously under glass. Planting outdoors enables a grower to keep benches of the previous year's crop in production during late spring and on until midsummer. With indoor planting the benches must be emptied in the spring so that a new crop of carnation plants can be benched. That is about the only justification of outdoor culture.

The labor involved in outdoor culture is much greater than when benching indoors. Disease and insect control is more difficult, and less effective outdoors. When properly handled, indoor culture gives production comparable to outdoor culture, despite the heavy bushy growth that plants make during the outdoor growing period. Apparently the damaging effect of lifting and benching heavy field plants during midsummer causes a check that offsets the heavier growth the plants make in the field. In any event the shoot count on field plants usually is far in excess of the cut record from the same plants.

Benching in indoor culture is done from April 1 to June 1, with a large proportion of this planting done during the month of May. Field planting is done outdoors as early in the spring as the ground can be properly worked, and after danger of severe freezing weather is past. The plants grow outdoors during May, June and July, and are benched before August 1.

OUTDOOR PRACTICES

In field culture, the plants are either set 6 or 7 inches apart in a row, with rows 18 to 24 inches apart for row culture; or, they are planted checkrow 6 to 8 inches apart in beds 3 to 4 feet wide. In bed plantings hand cultivation is used, usually with less damage to the plants than when mechanical cultivation is used in row culture. Some growers using bed culture steam-sterilize the semi-raised outdoor beds, thereby keeping weeding costs down and controlling soil-borne diseases. When sterilization is not used, carnations should not go back on the same field soil in less than five years.

If young plants are grown in bands indoors, the bands can be left on when planting in the field. Although this practice may restrict root growth some, there is much less transplanting shock later when the plants are lifted and brought indoors.

In field culture, spraying, as discussed in the section on Insects and Diseases, is essential for keeping the plants clean and healthy. Irrigation is not always a necessity, but is particularly valuable at planting time and for use just in advance of lifting the plants from the field.

Benching the field plants indoors should be completed not later than August 1. Careless handling in that operation, resulting in bruising and breaking of tops and roots, will affect production adversely throughout the subsequent flowering season. Frequently, disease organisms if present, can attack the plants at this stage, since there is considerable root injury and loss in the transplanting process. This is one of the major reasons why many growers have switched to direct benching of rooted cuttings.

DISEASES AND CONTROL—*Continued*

INDOOR CULTURE

Growers of miscellaneous crops, who can rotate carnations with other crops, find it easier to set up an indoor culture program than those who grow carnations exclusively. Even so, to use bench space effectively and efficiently, planned rotations are necessary. The following rotations are possibilities where houses or benches can be alternated between carnations and other crops every other year:

1. Late mums, followed by single-stem Easter snapdragons, then carnations.
2. Mums followed by lighted asters, then carnations.
3. Mums followed by lighted mums, then carnations.
4. Mums followed by stocks, then carnations.
5. Early winter snapdragons followed by second crop of snapdragons, then carnations.

Early benching of young carnation plants is an important factor in developing well-branched plants in indoor culture. Plants benched after June 1 seldom fill the bench well until the following spring.

(Note: Rooted cuttings benched direct after June 1 actually break more freely and provide heavier fall and winter production than do young plants benched at the same time from pots, bands, flats, etc.) In some sections, such as California, direct benching can be carried out as late as August 15, single pinched and still crop for Christmas.

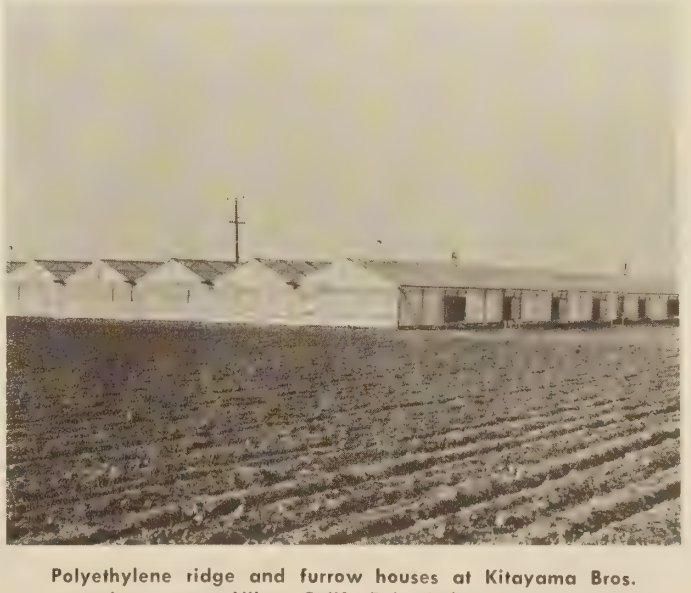
TWO-YEAR CULTURE

Growing carnation plants through for a second year's crop has been practiced more frequently the past decade, as a result of the development of more effective disease and insect control methods and materials. Unless a bench of carnations can be kept clean during the first year and the second summer, there is no need to consider carrying it through the second winter-flowering season.

The advantages of two-year culture are: One propagation, one planting operation, one changing or sterilizing of soil, etc., plus the fact that some varieties produce more in the second year than in the first. Disadvantages commonly found are reduced flower size and stem length the second year; the need for absolute control of diseases and insects; heavier watering and fertilizer requirements the second year, and greater problems in plant support.

Two procedures are in general use. One is to cut flowers continuously through the two years; the other, to gradually pinch or head back the plants in the spring, removing those shoots which would otherwise make summer flowers. The continuous procedure should be considered only for those varieties which produce flowers of good size, color and substance in hot weather and in those colors which sell during the summer months. Red, for example, is so little in demand during the summer, that it is better to pinch potential summer flowering shoots so that the comeback will be heavy in fall and winter when the demand is greater for red. *(continued)*

Interior view of polyethylene house. Note A—frame construction. Houses are covered usually in October and plastic will remain intact through May. Cheesecloth is used to cover the plants from June to October.



Polyethylene ridge and furrow houses at Kitayama Bros. carnation range, Niles, Calif. Polyethylene is 4 mils in thickness and is sandwiched between two layers of wire mesh for support. Note Barbrook 48-inch fans at intervals of 25 feet. (No wet pads.)

TWO-YEAR CULTURE—*Continued*

Pinching or heading back for second year production is a gradual process, not a chopping off or mowing off of plants. Starting about mid-April, pinch back all those shoots which would not flower before June 1. As new shoots come along and are long enough to pinch, repeat the procedure. Go over the bench at three-week intervals, making the last pinch about July 15. **This heading back results in much heavier fall and early winter production than the continuous cutting method.**

During the first year of two-year culture, the cutting or picking of flowers is done at somewhat lower levels on the plant than is the case when plants are being grown for only one season. This keeps down the overall plant height for the second season.

The greatest hazard in two-year culture is the unexpected loss of plants during the late summer between the two winter-flowering seasons. If the plants start dying out in groups it may then be too late to replant with carnations. If these losses are substantial, it is usually best to replace with a bench of snapdragons, stocks, etc., rather than nursing along a bench of ailing second-year carnation plants.

BENCHING

Special care should be taken so that bench soils are readily workable and have the proper moisture content at the time of the benching, otherwise the planting job will be slipshod and the young plants will be delayed in becoming established. Although the soil need not and should not be worked powder-fine, if it is too clumpy it is difficult to set the plants at the proper depth and spacing, and to provide complete contact between soil and roots. Soils that are too wet at planting time are difficult to work, whereas soils that are too dry frequently delay the plants in getting established. A grower of any experience knows when soils are suited for planting. Failure to put the soil in that condition may adversely affect the crop for weeks after planting.

Do not let the planting operaiton get far ahead of the watering. Water immediately after benching and water thoroughly. Set the plants the same depth they were before, or a little shallower. Never set them deeper.

SPACING

Spacings of 6 x 6, 6 x 8, 7 x 8, 8 x 8 inches are in common usage. Doubling up with two plants or increasing the number of plants in the row across the bench is practiced when plants are too thin to fill the bench with the regular spacing. Rooted cuttings benched direct, early planted indoor-grown plants, or field-grown plants, all can use about the same spacing in the bench. Spacing experiments have shown that even a 2 x 4 spacing will produce more blooms per square foot but the extra production is not enough to offset the increased price of planting more cuttings.

PINCHING

The object of the first pinch is to produce breaks or to cause the young plants to branch. Pinching also sets back or impedes the growth of the plant — the lower the pinch the greater the set-back. Pinch high, leaving a liberal amount of foliage. Some varieties, such as William Sim and its sports, require particularly high pinching.

The first pinch is made about one month after the cuttings have been potted, banded, flatted or benched. Let the second set of shoots reach eight or nine inches in length before pinching them, otherwise they will come back one-for-one.

Pinching is also used to time the crop, bringing in a heavier cut at desired times, and keeping the crop vegetative when demand is light. Varieties respond differently in length of time from pinch to bloom, and there is also a marked difference in response in any one variety at different seasons of the year. Pinching about mid-July has been the rule for bringing a number of varieties to crop in December. Closer regulation of timing now seems probable with the advent of the single pinch method used when rooted cuttings are benched direct.

Staggering the second and subsequent pinches through the spring and early summer months is a widely followed practice, aimed at spreading out the cut over a longer period of time.

Pinching is done most easily in early morning when the plants are turgid and the tip shoots snap off sharply. Spraying **Captan** immediately after pinching is a sound disease-prevention procedure.

DISBUDDING

Disbudding is a necessary and regular practice, calculated to throw all of the energy of each stem into the production of one large central flower.

Early removal of the side buds means fullest conservation of the energy for the main bud. However, from a practical standpoint, too much time is consumed in disbudding if the side buds are too small and too close to grasp easily and snap off.

With a little practice, the disbudder can learn the correct twist to snap off the side buds quickly and without tearing the flowering shoot. Disbudding is one of the most time-consuming jobs in growing carnations, and many growers have found it expedient to bring in part-time or after-school help to keep up with this work.

On some varieties used primarily for corasges or boutonnieres, it may be more profitable for retail growers to leave 3 or 4 buds per stem, letting each bud develop in turn and cutting the flowers without stems.

WATERING

Many growers maintain their carnation soils on the dry side. This practice probably developed as a result of the widespread prevalence of stem rots and the tendency of these rots to be more serious in moist soils. However, permitting carnation soils to become unduly dry hardens the plants and prevents optimum growth and production. For profitable operation it is better to rely on the more direct methods of preventing stem rots (see section on Diseases and Insects) and to water sufficiently and frequently enough to assure free and vigorous growth.

Avoid splashing and wetting the foliage. Insofar as this is possible it is good advice, for some diseases are spread in this manner. Water carefully and do not wet the foliage unnecessarily. However, the lower leaves can hardly be kept entirely dry, and it is advisable to take the following steps which minimize the dangers of wetting the foliage and spreading disease:

1. Water on bright days and finish watering as early in the day as possible so the foliage will dry before nightfall.
2. Ventilate freely during and after watering to keep down humidity and encourage drying of the foliage.
3. In conjunction with liberal ventilation, when outdoor temperatures permit, turn on additional heat to speed the rate of evaporation of water on the foliage.

During the summer months, on new and two-year plantings alike, water sufficiently to maintain active growth. Otherwise, the plants may become checked and hardened and never entirely regain their lost vigor.

Many watering devices such as Greco plastic hose, Skinner and White Showers nozzles have all been installed with varying success. They will all eliminate the high cost of hand watering. When installing surface watering, check your water supply and the capacity needed to irrigate your area. It is advisable to have an engineer figure out your requirements.

Watering using two lengths of Greco plastic hose.

Watering using Gates plastic hose with nozzles on edge of bed.

TEMPERATURE

A night temperature of 50° F. is optimum for carnations. Lower temperatures reduce and delay production, and higher temperatures reduce quality, particularly during the winter when daylight is inadequate. During an occasional cloudy day, a daytime temperature of 55° F. is satisfactory. For prolonged periods of cloudy weather it is better to hold the day temperature approximately the same as night temperature, that is, 50° F.

During bright sunny weather, daytime temperatures of 60 to 65 degrees are compatible with a 50° night temperature.

The importance of uniform temperatures can hardly be overemphasized. Fluctuating night temperatures are associated closely with splitting of flowers. This is particularly evident in early fall when boilers are not started up for the occasional cold nights. Two or three nights when the temperatures drop to the lower forties increases the incidence of splitting for several weeks thereafter. The value of automatic heat and temperature controls in carnation houses has been well established by many leading carnation growers.

LIGHT

In most carnation growing areas light is the limiting factor to maximum growth, production and quality during the winter months. Carnations should have the lightest house or bench available, and the glass should be kept clean. In areas where summer heat is intense, a light shading of the glass helps quality on benches which are in summer flower production. In those same areas, if the house is well ventilated, it is not desirable to shade houses in which carnations are not in crop.

When field plants are benched in midsummer, the glass should be shaded for a week or two, while the plants are recovering from transplanting shock. As soon as they are established, the shade should be removed. In contrast with this shading requirement for field plants, it has been found feasible to bench rooted cuttings direct from the sand during warm weather, **without** shading the glass. With strong, vigorous cuttings, losses have been virtually nil, and the young plants develop rapidly.

Supplementary artificial light hastens bud development, but also weakens stems and reduces flower petalage, and therefore has found no place in commercial production.

SUPPORTS

Carnations are supported by the wire-and-cross-string method. Wires are strung tightly lengthwise down the bench, with one wire between each row of plants. Strings are tied to the wires across the bench, separating the plants in that direction. The first set of supports is strung five or six inches above the soil. Additional sets of supports are spaced eight inches apart.

Much labor is saved and fewer stems broken if each set of supports is in place before the plants reach it. Maximum growth can be achieved and crooked stems kept to a minimum if the shoots can come up through or be trained through a waiting support. In some carnation ranges it is an established policy to have all sets of supports ready to lower in place at the time of benching or shortly afterward.

Since there is a continual need for support at all levels, the supports are kept in place until the plants are thrown out. Workers should go through periodically to straighten and train shoots through the proper openings of the cross-wire supports.

VARIETIES AND COLOR RATIOS

In most market areas the demand is for more than fifty per cent white and light pink combined, followed in order by red, dark pink, yellow and color novelties. The percentage of novelties demanded in most areas is extremely low, although notable exceptions exist, such as at San Francisco and Milwaukee. It is evident that retail florists have an important part in determining these color requirements, and some retail growers have found it profitable to grow sizable proportions of the novelties for their own trade, thus making their offerings more interesting and attractive than those of neighboring florists. However, the standard colors predominate in the bread-and-butter work of the vast majority of retailers.

Even with a recognized "best white" or "best red" variety, many growers prefer to grow more than one variety of a color. Because of the variation in cropping habits of the different varieties, such a procedure insures a steadier flower production. Also, since varieties "run out" or otherwise lose their desirability a grower is protected by having more than one variety of a color in production or on trial.

CUTTING, STORING, PACKING

Carnation flowers develop a little more size and quality if permitted to open on the plants, rather than being cut in tighter stages. Retail growers take advantage of this, allowing the flowers to develop to near-maturity before cutting. Wholesale growers cut at various stages, the degree of openess depending on market requirements, distances of shipping, etc. Most varieties will open in water after being cut, but a few blooms may go to sleep unless fully developed before cutting.

Both cutting and breaking of stems are practiced when picking flowers. Using a knife for cutting is more likely to spread disease from plant to plant. However, in breaking the stems, some damage is likely to be done to buds, shoots or stems below, so the superiority of either method is debatable.

Twenty-five is the standard number of flowers in the wholesale bunch. Other than that, grading standards are almost non-existent. However, the grower who uses uniformly good flowers in his regular grade and keeps culls, splits, crooks and shorts separate, is more likely to enjoy a higher average return. Flat packs and round bunches are both used. The important considerations in bunching are to prevent stem breakage and to keep bruising and crushing of flowers to a minimum.

After picking, carnations require a period of several hours or overnight of storing in water in a cool atmosphere to develop firmness. Cellars and natural storages serve fairly well during much of the year, but the advantages of artificial refrigeration for a warm weather cut are too obvious to be ignored. Temperatures of 33 to 40° F. are preferable to higher temperatures for carnations.

Experimental data released by the University of Illinois shows that cut flowers keep better at room temperatures or at various storage temperatures when the water in the containers tests approximately pH 4.0, as compared to water that is more acid or more alkaline. An addition to lowering the pH to 4.0, commercial flower preservatives should be added to strengthen the finished solution. When combined, water at pH 4.0 and containing preservatives will result in considerably greater flower-keeping quality.

Long-term cut flower storage is possible with carnations. Fischer reported that carnations stored in a moisture-proof container for four weeks at 31° F. had a post storage keeping quality of 7 days. The greatest application of long-term storage may come in storing carnations several weeks or a month in order to meet heavy seasonal demands. Completely line corrugated boxes with cellophane or polyethylene, pack the flowers as is the practice today, seal over the top of the cellophane to complete the moisture-proof atmosphere and refrigerate at 31°. Other ideas include the storage of flowers in large metal or waxed drums. For further information send for Cornell Extension Bulletin 853, "Commercial Storage of Cut Flowers", published by the New York State College of Agriculture, Cornell University, Ithaca, N. Y.

Carnations are extremely sensitive to ethylene gas. Small amounts of ethylene in the air will produce sleepiness in the flowers. To avoid this hazard observe the following rules:

1. Keep the storage box and the containers clean, never permitting any old, decayed or diseased flowers, stems or foliage to accumulate. They may give off ethylene gas.

2. Never store fruits, vegetables or arborvitae foliage in the same box since they also produce ethylene.

3. Be certain that coal gas and fumes from leaky gas pipes and burners never reach the flowers in storage.

BORON DEFICIENCY

SYMPTOMS: Research workers Mastalerz, Drake and Stechel at the Massachusetts Agricultural Experiment Station observed that boron deficiency caused abnormal flower and shoot growth. The following photographs illustrate the abnormal growths on carnations.

CONTROL: The growers who have observed symptoms as illustrated and have had the symptoms confirmed by the agricultural experiment station can correct this with one application of Borax at the rate of one ounce to 100 square feet of bench area. Never apply more than one application.

Research workers warn the user of trace elements to be very cautious as the plants require extremely small quantities when compared with nutrient elements such as nitrogen, phosphorus or potassium. Boron should be applied only when necessary and make doubly sure that your soil is deficient in this element.

(Left to right) Figure 1—Decrease in petal number results from boron deficiency. Figure 2—Pistils are more prominent because of decrease in petal number. Figure 3—Calyx ring can be seen on boron-deficient carnation. Figure 4—Boron deficiency causes epinastic curvature. Figure 5—In advanced stages of boron deficiency, immature buds die and become brown and papery.

(Left to right) Figure 6—Note vigorous growth of axillary shoots below aborted terminal bud. Figure 7—Witches-broom or proliferated axillary shoot growth below end bud. Figure 8—Leaf base splits, and axillary shoot grows through and below leaf. Note distortion of upper immature shoot. Figure 9—Leaf tips of boron-deficient plant become purple.

Photographs of Boron Deficiency provided through the courtesy of Dr. J. W. Mastalerz, formerly with the Mass. Agr. Exp. Sta. and now Professor of Floriculture at the Pennsylvania State University, University Park, Penna.

DISEASES AND THEIR CONTROL

FOLIAGE DISEASES

There are three foliage diseases: Alternaria Blight and Branch Rot, Rust and Bacterial Leaf Spot:

ALTERNARIA BLIGHT AND BRANCH ROT

SYMPTOMS: Alternaria blight and branch rot probably occurs wherever carnations are grown and is most serious on plants that have been grown in the field. This is an external disease and the symptoms appear on stems, leaves and occasionally on the flowers. Tiny purple spots are the first symptoms of the disease on the leaves, and later on the spots enlarge until a light brown, dead shrunken place appears in the center. Branches of the plant are usually infected on the nodes where they girdle the stem or branch, causing it to die. Brown spots later become black, as spores of the fungus appear on the surface.

The main source of infection occurs in the cutting bench. The fungus apparently does not live over in the field. The disease is spread from plant to plant in water during syringing operations or by splashing water in the field. The spores land on leaf surfaces, germinate and enter through stomata. Infection takes most rapidly about 70° F. and free water must be present for at least 8 to 10 hours.

CONTROL: Year-around inside culture with careful watering is the best preventive measure. For those who continue to grow out-of-doors, in addition to sanitation and other good cultural methods a regular weekly spraying of **Bordeaux Mixture** with a good wetting agent should be applied. Dimock has reported that **Orthocide** was very effective in the control of alternaria blight. When field culture is practiced, it is advisable to rebench as early as possible.

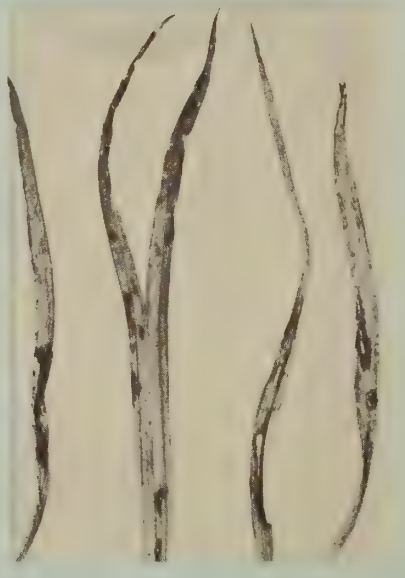
DISEASES AND CONTROL—*Continued*

RUST

SYMPTOMS: Rust attacks plants from the cutting stage to the mature plant. The fungus causing rust on carnations is not the same one as the one causing rust on snapdragons or asters. The characteristic reddish-brown pustules develop on the leaves and stems. These spores may be disseminated by wind rather than water but water must be present on the leaves for infection to take place. Only a few hours are required for infection. Fungus grows inside the tissue and two to four weeks later a new crop of spores are formed.

CONTROL: Rust infection will not take place when the plants are kept perfectly dry. Secure cuttings from rust-free plants only. Under some conditions such as leaky greenhouses and for those who cannot control the moisture of the hose, a spraying with either dry **Parzate** or liquid **Parzate** plus zinc sulfate should be followed. Use dry **Parzate** at the rate of 1 pound per 100 gallons and the liquid **Parzate** at the rate of 2 quarts of fungicide plus ¾ to 1 pound zinc sulfate plus a good spreader in each 100 gallons. Regular spraying every ten days to two weeks should control rust under rather unfavorable greenhouse conditions. **Orthocide** has recently been reported to be very effective in the control of rust.

Alternaria Blight — A lesion has girdled the stem and caused the death of the parts above. Black spore masses of the pathogen can be seen on surface of lesion.



Alternaria Leaf Spot — Spotting of leaves developed on cuttings infected in propagation bench.

BACTERIAL LEAF SPOT

SYMPTOMS: This disease is troublesome in some areas, especially areas like the Hawaiian Islands where carnations are grown out-of-doors and where there are frequent rains. The spots are circular or oval-shaped with purplish borders. Lower leaves are affected first and the disease then spreads upward by syringing or splashing water. Optimum temperature for its development is 75° F.

CONTROL: **Bordeaux Mixture** has proved to be the most effective.

DISEASES AND CONTROL—*Continued*

SYSTEMIC DISEASES

There are five diseases that can be classed as systemic, that is, the organism may be found in all parts of the plant: Fusarium wilt, Bacterial wilt, and three virus diseases, mosaic, streak and yellows.

FUSARIUM WILT

SYMPTOMS: Plants infected with Fusarium may show symptoms at any stage in their development. The first indication that a plant is affected with Fusarium wilt is a slow withering of the shoot. Often this is apparent on only one side of the plant and in young plants this results in a twisting and distortion of the plant. This wilting is usually accompanied by a change in color. First the leaves and stems change to a lighter gray-green and finally to a pale straw yellow. When infected stems are split, a brownish discoloration appears in the vascular tissue from the base upward. Extensive rotting of the roots usually does not occur until very late stages of the disease.

The fungus responsible for this disease can live in soil in the absence of carnations, so new infections can occur when healthy plants are planted in infested soil in the greenhouse or in the field. Cuttings from infected plants may also carry the disease. Infection usually takes place through the roots but it may also take place through wounds in the base of the main stem. Infections develop most rapidly at 75°-80° F. and at this optimum temperature for the disease the amount of infection is increased, the incubation period is shortened, and the rate of killing of infected plants is increased. Symptoms appear in 12 to 75 days following infection.

CONTROL: Complete rogueing of infected plants together with very careful selection of propagating material will help hold this disease down. Growers who are very serious about eliminating this disease should either culture stock for a propagating block or should pot-grow a few carefully selected plants and their progeny for a period of at least one year to be sure that the plants are not diseased, and then use them as a nucleus for further propagation of the variety concerned. The pots should be well spaced and extreme care should be exercised in avoiding recontamination.

A complete program of steam sterilization should be followed to completely eliminate this disease. Do not transport soil from old benches to new after soil sterilization.

Portion of lower stem and root of plant affected with Fusarium wilt. Brown streak was evident in vascular tissues of the stem. Root system is intact.

Rust postules on leaves.

DISEASES AND CONTROL—*Continued*

BACTERIAL WILT

Bacterial wilt is the disease that is causing most concern among carnation growers. It is a relatively new disease for carnations, first being found by Dr. L. K. Jones in Washington State in 1940.

Sudden wilting of the tops or some of the branches is a characteristic symptom of bacterial wilt. Either one or more branches on one side of the plant wilts or the whole plant wilts. Distortion due to the tendency of the plant to curl to one side as in Fusarium wilt is not evident when the plant is affected by bacterial wilt. Internally, the stems are yellowish to brown and if wilting is confined to one side, the discoloration is usually restricted to that side. The bark on the lower part of the stems disintegrates and becomes soft, and the discolored wood underneath is sticky to the touch. The root systems are rotted, most of them remaining in the soil when the plant is lifted. These roots also have a sticky character. This sticky character of disintegrating root and stem tissues distinguishes bacterial wilt and root rot diseases.

The bacterium responsible for the disease enters through the root and basal part of stem. This is a high temperature organism and it works most effectively during the summer when temperatures are in the 90's. It works slowly in the wintertime and infected plants may not show symptoms until summertime. This is important, as cuttings are frequently taken from apparently healthy plants in the winter and the disease does not become evident until hot weather.

CONTROL: Soil sterilization with steam only; otherwise the same general precautions as for Fusarium wilt. If hormones are used on the cuttings, apply them with a powder blower, never in a solution into which cuttings are dipped. Be sure to maintain the soil potassium over 20 p.p.m. and calcium 200 p.p.m. if bacterial wilt is suspected.

Bacterial Wilt — Infected plants with rotted roots.

Bacterial Wilt — Showing how top of plant is affected.

DISEASES AND CONTROL—*Continued*

VIRUS MOSAIC, STREAK AND YELLOWS

SYMPTOMS: Mosaic and streak have been present in carnation plantings for many years. Mosaic is very common but seldom causes extensive damage whereas streak is less common and is more injurious. Mosaic is evident as a mottling in young, actively growing leaves. When these leaves become older this pattern is no longer evident. Flower breaks that occur in King Cardinal and in some Sim varieties are due to mosaic and they are severe enough occasionally to produce cull bloom. Mosaic can be spread either by aphids feeding on infected plants or by rubbing the sap of a diseased plant into the leaves of a healthy plant. The virus can be transmitted to a number of garden pinks by these methods also, and in some of them the mosaic symptoms are more distinct than in the carnation plants themselves. Sweet William can serve as a good test plant for determining which carnations are affected with mosaic. Briefly, using the Sweet William test has failed to find a plant free of mosaic among a number of commercial varieties tested. Mosaic is not seed-borne, and seedlings will remain free unless contaminated.

Streak is marked by broken lines or streaks in the leaves. These short streaks may be white, yellowish brown, or purplish. These symptoms are plainly expressed in older leaves of established plants in spring, especially during March to May. Post reports (1947) that he found only slight expression of streak in St. Louis and Los Angeles plantings, but it was widespread in San Francisco and Denver greenhouses. Evidently low temperature intensifies the expression of the disease. Streak is transmissible by grafting. It does spread among plants grown out-of-doors and so some insect carrier of the disease is suspected, although none as yet has been found. Carnation yellows, caused by a combination of mosaic and streak viruses, is the most destructive of the carnation virus diseases. The disease produces loss of plants in addition to the decreased productivity and lowered quality of blooms.

CONTROL: Since all known standard varieties of carnation have mosaic, it is impossible to control this disease unless we start the stock from seedlings. Such is the case with the new Yoder Brothers varieties. These seedlings have been kept in isolation and away from all existing named varieties plus the control of all aphids.

Streak may be eliminated by careful rogueing and selection of propagating stock and by keeping the plants in screened greenhouses throughout the year. Some workers in Colorado believe that streak is no more than an expression of aster yellows which is spread only by aster leaf hoppers, so once a streak-free clone is established, it could be maintained in a healthy condition by screening and occasional rogueing.

Leaves of young shoot of healthy plant at left and mosaic plant at right. Leaves of healthy plant have a uniform dark green color; leaves of diseased plant are light green and mottled.

Mosaic in King Cardinal bud at left; healthy bud at right.

DISEASES AND CONTROL—*Continued*

ROOT AND STEM ROTS

There are two root and stem rot diseases: Rhizoctonia stem rot and Fusarium root rot.

RHIZOCTONIA STEM ROT

SYMPTOMS: The disease is characterized by a progressive wilting, collapse and browning of the entire plant, associated with a soft decay at the soil line. The stem at the soil level is soft and moist and the bark is easily rubbed off. It is not sticky, however, and the wood beneath the bark remains firm. The roots remain intact. The fungus Rhizoctonia is almost universally present in soil and it can attack carnations at any stage from the cutting bench to the mature plant in the bench. High soil temperatures and soil moistures both favor the disease, and losses are highest during the summer months. Deep planting also contributes to the efficiency of the disease.

CONTROL: Steam sterilization is the only preventive measure. Inside culture is by far the better over out-of-door culture. Dimock reports that in cases where Rhizoc begins to show up in an occasional spot in a sterilized bed, immediate drenching of the affected area and the soil for a couple of feet beyond the obvious infection with a suspension of **Semesan** at the rate of 1 pound to 50 gallons water or approximately 1 rounded tablespoonful per gallon will hold this disease in check. It might be advisable to make a second application at about half the above dosage rate in about ten days. Because there is always some danger of a little injury from the chemical, it is not recommended as a general prophylactic treatment, but suggested as a means of definitely stopping further advance of accidental contamination. Planting high, with the top of the original root ball somewhat above the general bench level, has been found quite effective in reducing trouble from Rhizoc.

Sciaroni reports that pentachloronitrobenzene (PCNB), known also as Terraclor, used at the rate of 2 to 3 pounds per 1000 square feet of area before planting gave excellent control of Rhizoc. The 75 percent wettable powder of PCNB was dusted on the soil surface and then raked into the top 1 to 2 inches. He also reports that when Rhizoc is found in established benches, a dusting of Terraclor in the affected area will stop the spread to healthy areas.

Yellows. Leaves from plant affected with both mosaic and streak.

FUSARIUM ROOT ROT AND STEM ROT

SYMPTOMS: Fusarium root rot and stem rot is distinct from Fusarium wilt. When plants are affected with root rot the entire plant wilts, the roots rot and slough away to the root base. Some rotting of the base of the stem may take place, but there is no extensive vascular discoloration as in Fusarium wilt or bacterial wilt. Extensive losses may occur in the cutting bench as diseased cuttings usually fail to root, or root poorly. When cuttings show red lesions near the base they should be eliminated. In spite of the most careful rogueing, however, not all of the infected plants can be removed. Keep rogueing constantly in nurse beds and in permanent beds. The disease is most serious in young plants and in soil that is kept excessively wet.

CONTROL: It has become apparent that a cultured cutting program will not control this disease, nor will a single application of a fungicide. Follow the general sanitation practices, such as steam sterilizing, proper use of the hose, and the avoidance of wet soil. It is apparent that the development and use of a soil mixture which cannot be overwatered would be a tremendous step in controlling Fusarium roseum.

Recent tests in California by Dr. Robert Roabe, University of California, have indicated that at least some promising control of Fusarium roseum in newly planted benches can be obtained through the use of **Pano-drench or Panogen 15** if the latter is available. This fungicide can be applied as a drench to the soil and we suggest that you follow manufacturers' directions in its use or check with us for latest information, as experimental work with this material is still in progress. Drenching the cutting beds just after the cuttings have been stuck will give excellent control. It can also be used as a cutting dip. Fusarium roseum apparently can be stopped from further spread in the bench by means of this treatment.

DISEASES AND CONTROL—*Continued*

FLOWER AND BUD ROTS

There are two flowers and bud rots of carnations: Botrytis flower blight and Fusarium bud rot.

BOTRYTIS FLOWER BLIGHT

SYMPTOMS: Petals of flowers affected with Botrytis turn brown either while in bud or after the flower opens. Frequently a number of petals may be matted together by the growth of the fungus and if the weather remains warm and moist the affected petals soon become covered with the brownish-gray growth of the organism. This brownish-gray growth is covered with a powdery mass of spores.

Botrytis flower blight occurs only during periods of extremely high humidity and the Botrytis spores are produced in large numbers when the atmosphere is warm and damp. Such conditions provide an ideal environment for the germination of the spores and growth of the organism. If the weather becomes dry the fungus does not develop further and the affected parts become brown, dry and brittle. This organism does not affect other parts of the carnation although it may affect many other kinds of plants. The spores are numerous and are readily disseminated by slight air currents.

Botrytis Flower Blight fungus growing on blighted petals on one side of opening bud.

CONTROL: The only proven control for this disease is proper use of heat and ventilation. Heat should be started in the houses an hour or two before sundown and if the vents are left open a bit so that the moisture-laden air can move out, there will be little trouble experienced with Botrytis blight. Northland is a very susceptible variety and should be planted in a south bench or in houses which have the best ventilation. Electric fans or blowers installed in the ridges of the greenhouses will circulate the air sufficiently and reduce the condensation of the moisture which is very necessary for the germination of Botrytis spores. The fans should be allowed to run continuously during the nighttime hours.

FUSARIUM BUD ROT

SYMPTOMS: The symptoms of Fusarium bud rot are quite different from those of Botrytis in that young buds may appear outwardly normal, but when opened they show a moist, brownish, decayed mass of the inner floral organs. These tissues may be rotted through by the Fusarium which is generally visible as a white cottony growth. Large white fat mites are also present in this tissue. White varieties of carnations are more susceptible than colored varieties.

This disease has a very interesting relationship. The fungus itself produces a disease on various common grasses known as silver top and these infected grasses are the source of the carnation disease. However, for infection to take place in carnations, a mite *Pediculopsis gramimium,* is necessary. This mite carries the fungus into the carnation buds and wounds the tissue so that the fungus can enter the tissue. Then the mite feeds on the fungus as it grows. Thus, there is a sort of symbiotic relationship between the disease organism and the insect. The mite is necessary to dissemination and infection by the organism and the growing organism is necessary for the subsistence of the organism.

CONTROL: Picking off the infected buds as soon as they are detected plus a good insect control practice in the greenhouse will check the spread of this disease.

INSECTS AND THEIR CONTROL

The insects attacking carnations are: aphid, cabbage looper, corn ear worm, four line leaf bug, Fuller's Rose beetle, fungus gnat, grass mite, greenhouse leaf tyer, leaf hopper, mealy bug, red spider mite, slug, sowbug, tarnished plant bug, thrip, variegated cut worm and wire worm.

Red spider mites, aphids and thrips are by far the most common of these pests. **TEPP, Parathion, Aramite, Dithio** and **Chlorobenzilate,** are effective as aerosols. **Parathion in spray, dust, or aerosol** controls all the insect pests which attack carnations excepting slugs which are controlled with a **metaldehyde** bait.

Root knot nematodes also affect carnation plants. The affected plants become dwarfed and yellowish and if the roots are examined one will find enlarged roots. The nematode is carried in the soil. Steam sterilization should be practiced.

YODER BROTHERS VARIETIES

WHITE

AURORA—exceptionally large white. Flower size and heavy stem are points of emphasis. Performs best in higher than average carnation temperatures. An average to heavy producer. (S-4)

ELECTRA—(New)—large informal white. Petals are deeply serrated. Exhibits the vigor, stretch and production of White Sim with an improved stem for winter flowering. Does not split. (P)

WHITE APOLLO—white sport of Apollo. Unequalled for year-round productivity. More versatile than Apollo since it is not subject to fading. (S-4)

SALMON PINK

AMBROSIA—(New)—a smooth and unvarying salmon pink. A shade lighter than Venus. Unusual stretch and rigid stemmed growth during the winter months. A durable flower for shipping. (P)

APOLLO—a widely accepted salmon pink. Consistency in providing top-quality flowers coupled with high productivity continue to lend favor to this variety. (S-5)

ATHENA—a lustrous salmon-pink slightly deeper than Venus and possessing a greater color clarity than Apollo under low light intensities. Has vigor, stretch and rigid stems. Does not split. (S-4)

VENUS—a large, salmon-pink. Flawless color. Like Charm, possesses superb flower qualities coupled with a long, rigid stem. A noted exhibition variety. Performs most satisfactorily at Littlefield temperatures. (S-3)

LIGHT PINK

APHRODITE—a true light pink. An early producer with an early comback. Best in high light intensity areas. (S-2)

DARK PINK

HERMES—a good dark pink with high temperature color-retention tolerance. Becomes a scarlet pink during the winter months. Ships and keeps well. Rarely splits. (S-2)

MENTOR—rich, rose-pink. Strong, rigid stems. Notable keeping and color retention properties throughout the year. (S-2)

SCARLET RED

RED APOLLO—(New)—an interesting dark salmon-red sport of Apollo. More heavily petalled and larger flower than its parent. Otherwise displays the same vigor and general growth habit of Apollo. (P)

SIREN—a bright scarlet. Combines heavy production with a fast comeback and uniform cropping on stems of medium length. (S-3)

THOR—a vivid scarlet of medium size. Especially recommended for its dependable color retention during high temperature periods. Free and rapid growth. (S-2)

CRIMSON RED

TITAN—an intense crimson-red. Dependable and continuous growth during the winter months. Recognized for its better than average shipping and keeping qualities among the crimson group. (S-1)

YELLOW

MIDAS—a dependable yellow. Best winter performance attained under high light intensities. Fast and reproductive. Tolerates closer spacing than Apollo or the Sim varieties. (S-3)

NOVELTIES

CASSANDRA—a lively yellow variegated. Pink pencilling. Rarely splits. Flower has excellent substance and is an outstanding keeper. (S-2)

NECTAR—large orange-yellow variegated with broad scarlet striping. (S-1)

(FOR PRICES SEE TABLE OPPOSITE PAGE)

ADDITIONAL VARIETIES OFFERED BY YODER BROTHERS

WHITE

Improved White Sim—S-4
Northland—S-2
White Littlefield—S-2

SALMON PINK

Salmon Sim—S-3

LIGHT PINK

Light Pink Littlefield—S-2
Pink Sim—S-3

DARK PINK

Sidney Littlefield—S-2

SCARLET RED

Cardinal Sim—S-3
Ember Sim—S-2
Red Sim—S-3

YELLOW

Improved Miller's Yellow—S-1
Harvest Moon—S-1

NOVELTIES

Strawberry Sim—S-1

Dark Frosted Sim—S-1

Gayety—S-1

Cooper's Variegated—S-1

Mamie—S-1

Scarlet Sim—S-1

CARNATION PRICE TABLE

Prices apply to the number of cuttings of any one variety on an order

Price Class	100-200	250-450	500-950	1000-2450	2500 & up
S-5	11.00	10.50	10.00	9.50	9.00
S-4	12.00	11.50	11.00	10.50	10.00
S-3	13.00	12.50	12.00	11.50	11.00
S-2	14.00	13.50	13.00	12.50	12.00
S-1	15.00	14.50	14.00	13.50	13.00
P	16.00	15.50	15.00	14.50	14.00

VARIETIES TO WATCH FOR THE FUTURE

The following varieties were displayed and scored at the New England New Varieties Day 1956. Their dissemination date will be announced.

SORENSON'S IMPROVED RED SIM—excellent red; scored 88.3 points, award of merit.

COUSIN'S DEEP SALMON LITTLEFIELD—a brick-red sport of White Littlefield; scored 90.3 points, award of merit.

CORINNE—yellow sport of Harvest Moon; more yellow than Braun's Yellow Sim; scored 87 points, award of merit.

DOTTIE—beautiful light pink sport of White Sim; very good, nice-shaped flower. Has tendency to become deeper at certain seasons of the year shading to a light salmon. Scored 95 points, award of merit.

SHIBUYA MEDIUM PINK—will command attention no matter where it is shown or displayed; sport of Mamie. Scored 88.6, award of merit.

CARNATION CUTTINGS

MEDIUM PINK

	per 100	per 1000
Boston—medium pink	$15.00	$125.00
*Charlene—bright rose pink	18.00	150.00

EDWARD WINKLER IMP.—**(New)**—deeper improved color than parent.
$22.00 per 100 $180.00 per 1,000

*HOOSIER PRINCESS—**(New)**—with lavender pink large flowers and few splits. Stems long and rigid.
25-275 $20.00 per 100 300-975 $18.00 per 100
1,000 up $16.00 per 100

*PORTRAIT—**(New)**—a distinctive brilliant rose-pink that holds its color at all seasons of the year. A mutation of Mamie with the same strong growing habits.
$90.00 per 500 $160.00 per 1,000
$50.00 per 250 minimum

Serenade—introduced by Colorado A & M	20.00	150.00

DARK PINK

Hermes—dark pink—see price table page 29—Code S-2
Mentor—rich rose—see price table page 29—Code S-2

Saugus Pink—deep pink	20.00	150.00
†Sidney Littlefield—large rose pink	15.00	125.00

LIGHT PINK

Aphrodite—light pink—see table page 29—Code S-2

*Dusty—**(New)**—pastel pink sport of William Sim; possesses keeping qualities and growth characteristics of parent; good shipper.
(250 minimum) $160.00 per 1,000

†Light Pink Littlefield—color similar to Hercules Virginia	15.00	125.00
Nancy Thompson—similar to light Pink Littlefield	15.00	125.00
†Pink Sim—light pink	20.00	150.00
Virginia Hercules—large Pink Virginia sport	12.00	100.00

SALMON PINK

Apollo—salmon pink—see price table page 29—Code S-5
Ambrosia—unvarying salmon pink—see price table page 29—Code P
Athena—(lustrous salmon pink)—see price table page 29—Code S-4

*BRAUN'S MED. PK. SIM—**(New)**—sport of Sim Gayety. Medium salmon pink. Very vigorous growth with excellent production.
$180.00 per 1,000, 500 up $220.00 per 1,000, 200-450

WE CAN SUPPLY ANY VARIETY NOT LISTED ABOVE

***Patented or restricted varieties**
†These varieties also produced by Yoder Brothers. For prices see page 29.

CARNATION CUTTINGS—*Continued*

	per 100	per 1000
Debbie—salmon pink Sim sport	20.00	150.00
*FLAMINGO PINK SIM—**(New)**—dark salmon sport of Mamie Sim. Growth similar to parent except not as many cuttings (or grass) on the stems. Seldom splits and not as tall a grower as Sim. Size of flowers 3¼" to 3½". (250 minimum)	$20.00 per 100	$150.00 per 1000
Laddie Sim—Sport of Sim	20.00	150.00
Mr. Pink—(Catron's Pink)—light salmon pink	15.00	125.00
Pink Beauty—sport of Pink Sim	15.00	125.00
*SALMONAISE—**(New)**—salmon pink sport of Virginia Hercules. $20.00 per 100		$180.00 per 1000
†Salmon Sim	20.00	150.00
*SCHEIDEN'S PINK—**(New)**—a salmon pink sport of Vulcan. Flower comparable in color and form to Venus, but with much better production. Strong stems all seasons. (250 minimum)		$150.00 per 1000
Shocking Pink Sim—brilliant dark salmon	15.00	125.00
Venus—large salmon pink—see price table page 29—Code S-3		

WHITE

Aurora—large white—see price table page 29—Code S-4		
Electra—large informal white—see table page 29—Code P		
†Northland—large white	12.00	100.00
Snowdrift—cross of Sidney Littlefield & Golden Wonder	20.00	150.00
White Boston—sport of Dark Pink Boston	15.00	125.00
†White Littlefield—sport of Sidney Littlefield	15.00	125.00
†White Sim—a very popular white	15.00	125.00
†Imp. White Sim—white sport of Wm. Sim	15.00	125.00
White Apollo—sport of Apollo—see price table page 29—Code S-4		

CRIMSON

Congo—large crimson	15.00	125.00
Crimson Prince—very productive deep crimson	20.00	150.00
Mrs. C. W. Weld—deep crimson	15.00	125.00
Titan—crimson red—see price table page 29—Code S-1		

RED

†Cardinal Sim—shade lighter than Wm. Sim	15.00	125.00
Dark Red Sim—shade darker than Wm. Sim	15.00	125.00
†Ember Sim—brilliant sport of Wm. Sim	15.00	125.00
Hill's Improved Red Sim—sport of Wm. Sim	15.00	125.00
*Jumbo Cardinal—deep cardinal. 25-275, $15.00 per 100; 300-975,	12.50	100.00
*Majestic—cross of Wm. Sim		150.00
Nolte's Navajo Sim—**(New)**—sport of White Sim	20.00	180.00
Red Apollo—dark salmon red—see table page 29—Code P		
†Red Sim—improved Wm. Sim	15.00	125.00
Siren—bright scarlet—see price table page 29—Code S-3		
Tetra Red—tetraploid Wm. Sim	20.00	150.00
Thor—intense scarlet—see price table page 29—Code S-2		
*William Sim—standard red		125.00

WE CAN SUPPLY ANY VARIETY NOT LISTED ABOVE

***Patented or restricted varieties**
†These varieties also produced by Yoder Brothers. For prices see page 29.

(Turn Page)

CARNATION CUTTINGS—*Continued*

YELLOW

*BRAUN'S YELLOW SIM—**(New)**—sport of Harvest Moon. Pure yellow, almost identical in shade to Miller's Yellow. Vigorous growth.
$200.00 per 1000

*BRIGADOON—**(New)**—lemon yellow. Colorado A & M introduction. Not a Sim sport. A new seedling from White Sim and Miller's Yellow. Improves production of Miller's Yellow.
$200.00 per 1,000 (500 minimum)

	per 100	per 1000
†Harvest Moon—yellow gold sport of Wm. Sim	15.00	125.00
†Imp. Miller's Yellow-clear intense yellow—see price table page 29—Code S-1		
Midas—a good yellow—see price table page 29—Code S-3		
Shirley Ann—color improves Miller's Yellow	15.00	125.00

NOVELTIES

Anniversary—improved Scarlet Sim	15.00	125.00
Cassandra—yellow variegated—see price table page 29—Code S-2		
†Dk. Frosted Sim—less intense Scarlet Sim—see price table page 29—Code S-1		
†Cooper's Variegated—variegated red and White Sim	15.00	125.00
†Gayety—variegated red and white Sim	15.00	125.00
Lavender Rose—lavender	15.00	125.00
†Mamie—white with red splotches	15.00	125.00
Nectar—orange yellow, scarlet stripes. See price table page 29—Code S-1		
Pearson's Peppermint Sim—white with red stripes	15.00	125.00
Peking Pink Littlefield—scarlet white tipped	15.00	125.00
Pelargonium—maroon with white edge	15.00	125.00
Peppermint Stick Littlefield—red and white	15.00	125.00

S. ARTHUR SIM—**(New)**—pure white background with very striking even red pencilling marks throughout the flower. Same color year round. Sport of Cardinal Sim. Does not split.
$15.00 per 100 $125.00 per 1,000

*Sarah Jane Knipe—magenta with silver edges. 25-275, $15.00 per 100; 300-975	12.50	100.00
Scarlet King—sport of Pelargonium	15.00	125.00
†Scarlet Sim—similar to Scarlet King	15.00	125.00
*Sophie—white, variegated pink	20.00	175.00
†Strawberry Sim—variegated red and pink Sim Sport—See price table page 29—Code S-1		
*Tetra-Sarah Jane—a tetraploid Sarah Jane Knipe. 25-275, $25.00 per 100; 300-975	20.00	150.00
Variegated Lavender Littlefield—bluish pink	15.00	125.00

WE CAN SUPPLY ANY VARIETY NOT LISTED ABOVE

***Patented or restricted varieties**

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INSECTICIDES, FUNGICIDES AND FUMIGANTS

Aldrin (25%)			4 lb. bag	2.00
Aramite 15W			4 lb. bag	3.20
Chlorobenzilate 25W			4 lb. bag	4.20
Deenate 50-W (DDT)	4 lbs.	2.25	48 lb. Case (12 - 4 lb. bags)	21.60
Dieldrin (50%)			4 lb. bag	6.60
Fermate	3 lbs.	2.45	Case (36 lbs.)	25.80
	Carton (24 cans)			
Fulex Parathion Fumigators	1,000 cu. ft.	10.50	5,000 cu. ft.	13.50
For Red Spiders, Aphids, and Thrips	2,000 cu. ft.	10.50	10,000 cu. ft.	16.10
			20,000 cu. ft.	25.00
Fulex Aphid-Smoke Fumigators	1,000 cu. ft.	10.00	5,000 cu. ft.	13.00
For Aphids and Adult White Flies	2,000 cu. ft.	10.00	10,000 cu. ft.	16.00
			20,000 cu. ft.	24.00
Fulex Spider-Mite Fumigators				
For Red Spiders, including some Parathion-resistant strains on carnations, chrysanthemums and snapdragons	1,000 cu. ft.	10.50	5,000 cu. ft.	13.50
	2,000 cu. ft.	10.50	10,000 cu. ft.	18.00
			20,000 cu. ft.	30.00
Isotox 1 (supplied in 50 lb. bags only)	50 lbs.	8.50		
Kelthane Emulsion 18.5	gal.	15.75	Case (4 1-gal.) per gal.	15.00
Kelthane Wettable 18.5	3-lb. bag	5.55	Case (16 3-lb. bag) per lb.	1.70
			50 lb. bag per lb.	1.65
Lindane (25%)			4 lb. bag	7.60
Malathion (25%)			4 lb. bag	3.25
Mildex			3 lb. bag	5.80
Nicofume Liquid			gallon (8 lbs.)	13.80
Nicofume Pressure Fumigators	½ lb. cans (12 cans)			5.65
	1 lb. cans (12 cans)			10.70
NNOR			gal.	10.00
Optox (10% DDT)			gal.	12.00
Orthocide 50 W	5 lbs.	5.70	50-lb. drum	54.00
Plantfume 103	5,000 cu. ft. carton		— 36	10.50
	20,000 cu. ft. carton		— 12	12.00
Pano-drench			1 oz.	1.95
	4 oz.	5.95	16 oz.	19.20
Parathion Spray 15% Wettable			4 lb. bag	3.50
Parzate (Powder)	3 lb. bags	2.85	Case (36 lbs.)	31.20
(Liquid)			5 gal. cans	9.50
P-40	25 lbs.	20.00	50 lbs.	37.50
			100 lbs.	70.00
Snailicide	5 lbs.	4.00	20 lbs.	13.00
Snarol	6 lbs.	2.00	50 lbs.	9.75
Sodium Selenate	4 oz.	7.00	1 lb.	23.00
Terrachlor 75 WP			5 lb.	4.50
Vapotone XX			1 gal.	12.00
Zerlate	3 lbs.	2.45	Case (36 lbs.)	25.80

Prices subject to change without notice.

For your other needs refer to your

Gloeckner *Chrysanthemum Manual and Seed Catalog*

or see your Gloeckner Representative


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CARNATION MANUAL
1957 EDITION
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